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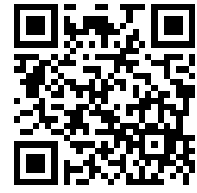

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WEST COAST OF INDIA PILOT

COMPRISING
THE WESTERN COASTS OF CEYLON,
INDIA AND PAKISTAN
FROM COLOMBO TO CAPE MONZE,
ALSO
THE MALDIVE AND LACCADIVE ISLANDS

TENTH EDITION
1961

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Notations of Supplements and Annual Summaries of Notices to Mariners relating to this book

TO BE FILLED IN BY NAVIGATING OFFICER

(*In Chart Depots the first two columns only are to be filled up.*)

Title	Date of publication and number	Date of insertion of note in margins of book
Notices to Mariners	1st January (annually) Nos. 1-20	see following page

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Important

Attention is called to Admiralty Notices to Mariners Nos. 1-20 of the **current year** which contain the following information:—

No. 1 Caution when approaching British and Commonwealth Ports.
- Part I Closing of Ports; Stopping of movement in Ports.
- Part II Examination Service.
- Part III Other Regulations in force.

No. 2 Notice to all Mariners, Shipowners and others concerned.—Agents for sale of charts and hydrographic publications.

No. 3 Official Radio Messages to British Merchant Ships.—"The G.B.M.S. Organisation."

No. 3A Official Messages to British Merchant Ships (Small Craft and Fishing Vessels).

No. 3B Official Radio Messages to Merchant Ships. The Mercast System.

No. 4 Aircraft. Communications—Signals.

No. 5 Firing Practice and Exercise Areas.

No. 6 International Code of Signals, 1931. Amendment.

No. 7 Caution with regard to ships approaching Squadrons or Aircraft Carriers, etc.

No. 8 Information concerning Submarines.

No. 9 British Isles.—Warnings broadcast by Coast Radio Stations.

No. 10 Minesweeping Operations.

No. 11 British Isles.—List of Storm Signal Stations.

No. 12 Submarine Cables.

No. 13 Radio Navigational Warnings.

No. 14 Availability at Commercial Ports of Notices to Mariners and NEMEDRI Route-Books.

No. 15 Laws and Regulations Appertaining to Navigation.

No. 16 Admiralty Tide Tables. Addenda and Corrigenda.

No. 17 Reports of Shoals obtained by Echo sounding. Instructions regarding rendering.

No. 18 Areas Dangerous due to Mines: Swept Routes.

No. 19 The International Hydrographic Bureau.

No. 20 British Merchant Ships—Use of Radar in time of Emergency or War.

Copies of these Notices can be obtained **gratis** *by Masters of Ships from Mercantile Marine Offices in the United Kingdom. Copies may also be inspected at Commonwealth and Colonial Government Shipping Offices and at British Consulates.*

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Caution 1

This Volume should not be used without reference to the latest Supplement and Annual Summary of Notices to Mariners affecting it which may have been published.

A supplement to this volume will generally be published annually until the latter is again taken up for revision.

After the publication of Supplement No. 1, each succeeding supplement cancels the former.

Between the time of the volume being taken up for revision and the publication of the new edition no supplement will be issued, but early in each year a Summary of the Admiralty Notices to Mariners affecting the volume, which have been published during the preceding year, will be issued as a separate publication.

The publication of all Supplements and Summaries of Notices to Mariners is announced in Admiralty Notices to Mariners.

The latest Supplement and any Annual Summary of Notices to Mariners that has been published affecting this volume will be obtainable gratuitously by purchasers of this volume from the Agents for the sale of Admiralty charts and other Hydrographic publications, on application either personally or by letter ; in the latter case the cost of postage must be enclosed. For a list of these Agents *see* Admiralty Notice to Mariners No. 2, published annually.

Information of a temporary nature is not included in this volume, nor in the Supplements thereto.

Caution 2

Details of Lights, Fog Signals, and Time Signals (visual) are not included in this volume; for this information the **Admiralty List of Lights, Volume 6,** should be consulted.

Information regarding Vertical Movement of the Water is not included; for this the **Admiralty Tide Tables** should be consulted.

Details of Radio information (weather bulletins, storm and navigational warnings, time signals, radiobeacons, and D.F. stations) are not included; for this information the **Admiralty List of Radio Signals** should be consulted.

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Caution 3

In this work the bearings are referred to the true compass, and when given in degrees are reckoned clockwise, from 000° (North) to 359°.

The bearings of lights are given from seaward.

The latitudes and longitudes given in the text are approximate.

The distances are expressed in sea-miles of 60 to a degree of latitude.

A cable's length is assumed to be equal to the tenth part of a sea-mile. It is often accepted as being one tenth of a nautical mile.

The depths are given below chart datum level where not otherwise stated.

Heights on the land are given above mean level of high water spring tides.

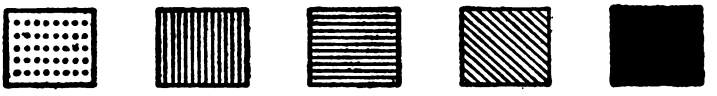
Figures in brackets given after those denoting feet, fathoms and yards are their equivalents in metres.

Time is expressed in the four-figure notation commencing at midnight.

The term "power vessel" used herein includes any vessel propelled by machinery.

A name in brackets, immediately following another name, is the obsolete name which is still shown on the Admiralty Charts. As a general rule, the bracketed name is only inserted in the description of the place or object previously bearing that name.

When shading is used to indicate colours of flags, tidal light signals, or beacons, it is as follows:



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S. D. No. 38

WEST COAST OF INDIA PILOT

Comprising the
West Coasts of Ceylon and India
and the Coast of West Pakistan
from Colombo to Cape Monze,
also
the Maldive and Laccadive Islands

TENTH EDITION, 1961

London
Published for the Hydrographic Department, Admiralty
1961

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Agents for the Sale of Admiralty Charts

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Advertisement to the Tenth Edition

The West Coast of India Pilot contains Sailing Directions for the west coasts of Ceylon and India and the coast of West Pakistan, from Colombo to Cape Monze, also for the Maldive and Laccadive islands.

This, the tenth edition, has been prepared by Lieutenant Commander J. D. Lock, R.N., and contains the latest information received in the Hydrographic Department.

The meteorological information has been revised by the Meteorological office of the Air Ministry. Temperature is expressed in degrees Fahrenheit, rainfall in inches, speed in knots and distance in sea miles, unless expressly stated otherwise. Information received from meteorological services which do not use these units has been converted into the units mentioned above by the Meteorological Office.

The information on radar ranges, tabulated in Appendix III, has been prepared and supplied by the British Shipowners' Radio Advisory Service.

Mariners and others are invited, in the interest of navigation, to forward to the Hydrographer of the Navy, Admiralty, Oxgate Lane, Cricklewood, London, N.W.2, any information that may come under their notice which would be useful for the correction of charts and other hydrographic publications issued by the British Admiralty; *early* advice as to newly discovered dangers, the establishment of, or changes in, any aids to navigation, is especially requested.

Copies of a form (H.102) on which to render information can be obtained ***gratis*** from The Hydrographer of the Navy, Hydrographic Supplies Establishment, Creechbarrow House, Taunton, Somerset, or from any of the agents in Great Britain and abroad, a list of whom is published annually in Admiralty Notice to Mariners No. 2.

By the publication of this volume, the ninth edition of the West Coast of India Pilot, 1950, and its Supplement No. 5, 1960, are cancelled; all information affecting that work contained in Notices to Mariners, up to and including No. 1382 of 1961, has been embodied in this volume.

For Temporary and Preliminary Notices to Mariners affecting this edition, the list of Temporary and Preliminary Notices to Mariners in force, published monthly in the weekly edition of the Admiralty Notices to Mariners, should be consulted.

E. G. IRVING,
Rear-Admiral,
Hydrographer of the Navy.

Hydrographic Office,
Admiralty, London,
16th June, 1961.

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Bibliography

The following publications, other than British Government publications, have been consulted in preparing this edition:—

INDIAN

Times of India Directory and Year Book, 1960–61.

BRITISH

Statesman's Year Book, 1960.
Whitaker's Almanack, 1961.
Ports of the World, 1960.

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WEST COAST OF INDIA PILOT

TENTH EDITION 1961

Summary of Admiralty Notices to Mariners affecting the above Volume, issued between the date of going to press (16th June, 1961) and the date of the Admiralty Notice to Mariners announcing publication (No. 823 of 11th April, 1962).

Blocks for the correction of charts are *not* included in this summary.

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1451. INDIA, W. COAST—GULF OF KUTCH—Okha—Shoals.

(1) Shoal soundings are to be inserted as follows :—

(*a*)	3 fathoms	2 feet	in position	045°	4·2 cables.	}	from Samiani Island light (22° 29′ 15″ N., 69° 05′ 10″ E. approx.).
(*b*)	2 ,,	4 ,,	,,	130°	2·8 ,,		
(*c*)	2 ,,	,,	,,	141°	3·0 ,,		
(*d*)	1 ,,	2 feet	,,	174½°	9·7 ,,		
(*e*)	1 ,,	4 ,,	,,	178°	9·6 ,,		
(*f*)	1 ,,	5 ,,	,,	181½°	9·7 ,,		

(2) Soundings are to be expunged as follows :—

(*a*)	4 fathoms	4 feet	close	N.E. of	(1*a*).
(*b*)	3 ,,	1 ,,	,,	N. ,,	(1*b*).
(*c*)	3 ,,	2 ,,	,,	N. ,,	(1*d*).
(*d*)	3 ,,	1 ,,	,,	E. ,,	(1*d*).
(*e*)	3¼ ,,		,,	N.W. ,,	(1*f*).

(3) Fathom lines are to be amended as follows :—

(*a*) The 3-fathom lines are to be amended to enclose (1*b*, *c*).

(*b*) A 3-fathom line is to be inserted to enclose (1*d*-*f*).

Charts [*Last correction*].—**1321 (plan, Okha)** (1, 2*a*-*c*, 3) [*527/61*]—**47** (1*a*, *d*, *f*, 2*a*, *b*, *e*, 3*b*) [*2585/59*]—**43** (1*d*, 2*d*, 3*b*) [*376/60*].
W. Coast of India Pilot 1961 p. 300.
Dehra Dun Notice 66/61. (*H. 2905/59.*)

2032. INDIA, W. COAST—Baia de Mormugao—Buoyage altered.

A red can buoy is to be inserted S.W. of Roca Mormugao in position 297° 2,600 feet from the Fl. W.R.G. light (15° 25′ 05″ N., 73° 47′ 30″ E. approx.). The light-buoy about 1,000 feet E.S.E. is to be expunged.

Chart [*Last correction*].—**492** [*1315/61*].
W. Coast of India Pilot 1961 p. 194.
Goa Notice 2/61, & Clyde & Co. (*H. 4196/61.*)

2092. INDIA, W. COAST—GULF OF CAMBAY—Gogha—Light altered.

(1) The light (21° 41′ 30″ N., 72° 16′ 35″ E. approx.) is now *Occ. R. 15 sec. 60 ft. 13 M.* It is shown from a white square masonry tower with red bands, 40 feet in height.

(2) The two Obscured arcs of the light in (1) are to be expunged.

Charts [*Last correction*].—**1035** [*2259/60*]—**51** (1) [*671/61*].
Light List Vol. 6/60, 0452. W. Coast of India Pilot 1961 p. 268.
Dehra Dun Notice 100/61. (*H. 3591/61.*)

2100. INDIA, W. COAST—Tarapúr Harbour—Lights established.

(1) A light-star, *Gp. Fl. (3) 45 sec. 82 ft. 15 M. & F.R. 38 ft. 11 M.*, is to be inserted in position 203¾° 9·4 miles from Dahanu light (19° 58′ 30″ N., 72° 43′ 30″ E. approx.). *On Chart 1012* a light-star "*Tarapur*" is to be inserted in position 19° 50′ 00″ N., 72° 39′ 30″ E. The lights are shown from a white square masonry tower with black bands, 75 feet in height.

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(2) The *Fixed Red* sector of the new light in (1) is to be inserted from 157° through W. to 009°.

Charts [*Last correction*].—**736** [*2440/60*]—**2736** (1) [*1052/61*]—**826** (1) [*1315/61*]—**1012** (1) [*New Chart, 21/7/61*].
Light List Vol. 6/60, 0491·5. W. Coast of India Pilot 1961 p. 256.
Dehra Dun Notice 101/61. (*H. 3729/61.*)

2535. INDIA, W. COAST—Port Bankot—Buoy established Westward.
A conical buoy, black and white vertical stripes, is to be inserted in position 277½° 65·0 miles from Fort Savaradrug light (17° 48′ N., 73° 04′ E. approx.).

Charts [*Last correction*].—**2736** [*2100/61*]—**L(D7) 2736** [*New Chart, 10/11/61*]—**826** [*2100/61*].
W. Coast of India Pilot 1961 p. 222.
Dehra Dun Notice 121/61. (*H. 4759/61.*)

1962

317. INDIA, W. COAST—GULF OF CAMBAY—Suvali Point—Light altered.
Tapti light (21° 05′ 00″ N., 72° 37′ 45″ E. approx.) is now *Gp. Fl. (3) 15 sec. 104 ft. 16 M.* It is shown from a white round tower, 58 feet in height.

Charts [*Last correction*].—**735** [*2261/60*]—**51** [*2092/61*]—**2736** [*2535/61*].
Light List Vol. 6/60, 0476. W. Coast of India Pilot 1961 p. 260.
Dehra Dun Notice 22/62. (*H. 6692/59.*)

318. INDIA, W. COAST—MALABAR COAST—Koilthottam—Light altered.
The light (8° 59′ 45″ N., 76° 32′ 15″ E. approx.) is now *Fl. 5 sec. 64 ft. 13 M.* It is shown from a white square masonry tower with black bands, 50 feet in height.

Charts [*Last correction*].—**750** [*2442/60*]—**827** [*1315/61*].
Light List Vol. 6/60, 0710. W. Coast of India Pilot 1961 p. 146.
Dehra Dun Notice 26/62. (*H. 484/62.*)

522. INDIA, W. COAST—KATHIAWAR COAST—Jafarabad Harbour and Approach—Information about Lights and Fog Signal.
(1) The Fl. light (20° 51′ 25″ N., 71° 22′ 50″ E. approx.) is to be amended to *Fl. 10 sec. 95 ft. 16 M. & F.R. 27 ft. 10 M.* The Fl. light is shown from a six-sided masonry tower, 51 feet in height; the F.R. light from a square hut 10 feet in height.

(2) "*Nauto*" is to be inserted against the light in (1).

(3) The *Fixed Red* sector of the light in (1) is to be inserted from 248° to 267°.

(4) The Fl. R. light on the dangerous wreck "(Masts)" (20° 51′ 45″ N., 71° 26′ 00″ E. approx.) has been discontinued and is to be expunged.

Charts [*Last correction*].—**1779 (plan, Jafarabad Harbour)** (1–3) [*1357/60*]—**50** (1, 2, 4) [*1357/60*]—**2736 & L(D7) 2736** (1, 2) [*317/62*]—**826 & L(D7) 826** (1, 2) [*2535/61*].
Light List Vol. 6/60, 0432 & 0432·2. W. Coast of India Pilot 1961 pp. 279 & 280.

Dehra Dun Notices 32 & 33/62. (*H. 1003/57 & 4600/54.*)

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523. INDIA, W. COAST—KATHIAWAR COAST—Mahuva Bandar—Light altered.

Jegri Bluff light (21° 02′ 25″ N., 71° 48′ 10″ E. approx.) is now *Gp. Fl. (2) 20 sec. 185 ft., 19 M.* It is shown from a square masonry tower, 94 feet in height.

Charts [*Last correction*].—**1779 (plan, Mahuva Bandar)** [*522/62*]—**50** [*522/62*]—**2736 & L(D7) 2736** [*522/62*]—**826 & L(D7) 826** [*522/62*].
Light List Vol. 6/60, 0438. W. Coast of India Pilot 1961 p. 275.
Dehra Dun Notice 34/62. (*H. 1302/59.*)

530. INDIA, W. COAST—Bombay Harbour—Spoil Grounds and Light-Buoy established.

(1) The following positions are to be joined by pecked line:—

Area I.		Area II.	
(*a*)	18° 53′ 12″ N., 72° 44′ 14″ E.	(*e*)	18° 46′ 50″ N., 72° 48′ 14″ E.
(*b*)	18° 53′ 12″ N., 72° 44′ 46″ E.	(*f*)	18° 46′ 33″ N., 72° 48′ 39″ E.
(*c*)	18° 52′ 42″ N., 72° 44′ 46″ E.	(*g*)	18° 46′ 09″ N., 72° 48′ 20″ E.
(*d*)	18° 52′ 42″ N., 72° 44′ 14″ E.	(*h*)	18° 46′ 27″ N., 72° 47′ 55″ E.

"*Spoil Ground*" is to be inserted within each area.

(2) A can light-buoy, black and yellow vertical stripes, *Fl. 3½ sec.*, is to be inserted at (1*f*).

Charts [*Last correction*].—**2621** [*1279/61*]—**737** (2) [*1052/61*]—**L(D7) 737 (2)** [*New Chart, 10/11/61*].
W. Coast of India Pilot 1961 p. 242.
Dehra Dun Notice 35/62. (*H. 7674/58.*)

796. INDIA, W. COAST—GULF OF KUTCH—Okha Approach—Light altered.

The Fl. R. light (22° 29′ 30″ N., 69° 05′ 25″ E. approx.) is now *Fl. R. 3 sec. 34 ft. 5 M.* The height of the light tower is 30 feet.

Charts [*Last correction*].—**1321 (plan, Okha)** [*1451/61*]—**47** [*1568/61*]—**43** [*1568/61*].
Light List Vol. 6/60, 0388. W. Coast of India Pilot 1961 p. 298.
Dehra Dun Notice 42/62. (*H. 4143/56.*)

797. INDIA, W. COAST—KANARA COAST—Kundapur Approach—Shoal.

A shoal sounding of 3 fathoms is to be inserted in position 288° 3·85 miles from the F. light (13° 37′ 20″ N., 74° 40′ 25″ E. approx.).

Charts [*Last correction*].—**745** [*1525/61*]—**827** [*318/62*].
W. Coast of India Pilot 1961 p. 175.
Dehra Dun Notice 47/62. (*H. 1248/62.*)

C.B.H. 1804 - Wt. 8098 - Dd. H. 0324-8, 110 - 4/62

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Glossaries

of Foreign words used in this volume

Ar (H)	River	Kari, Khari (H).	River
Ar, Aru (T) . . .	River	Kunnu (M) . .	Hillock
Bandar (A) (G) . .	Harbour	Mala (M) . .	Hill
Bet (G)	Island	Oya (S) . . .	River
Gala (S)	Stone	Pir (U) . . .	Saint
Ganga (S) . . .	River	Puzha (M) . .	Stream
Guda (Tel) . . .	Hamlet	Rann (G) . .	Salt or sand waste
Gudda, Gudde (T) . .	Hill	Ras (A) . . .	Point
Halla (K) . . .	Stream	Sarkarun (H) .	Customs or port officer
Idgah (U) . . .	Place of prayer	Tanni (T) . .	Water
Jinjira (H) . . .	Island	Tivu . . .	Island
Kadavu (M) (T) .	Crossing		

A = Arabic, G = Gujarati, H = Hindi, K = Kannada, M = Malayalam, S = Sinhalese, T = Tamil, Tel = Telugu, U = Urdu.

PORTUGUESE

Portuguese	*English*	*Portuguese*	*English*
Baia . . .	Bay	Morro . .	Hill, rock
Banco . . .	Bank	Planalto . .	Headland
Cabo . . .	Cape	Ponta . . .	Point
Enseada. . .	Bay	Pôrto . . .	Port
Fortaleza . .	Fortress	Recife . . .	Reef
Forte . . .	Fort	Rio . . .	River
Ilha, ilhéu . .	Island	Roca . . .	Rock
Ilhas. . . .	Islands	San . . .	Saint
Monte . . .	Mountain		

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SYSTEM OF ORTHOGRAPHY

The following rules for the spelling of geographical names (termed P.C.G.N. Principles) have been adopted for British official use, and the names in Admiralty Hydrographic publications will be rendered in accordance with these rules as opportunity occurs.

In new editions of the various volumes of sailing directions names are, generally speaking, given in accordance with these rules, but where the name on the chart shows an older rendering of a name, such chart name is given in brackets after the new rendering and will also be given in the Index.

The rules for spelling in the P.C.G.N. Principles are as follows:—

(1) The spelling of the names of (*a*) regions and geographical features of continental or inter-national extension, (*b*) water-areas extending beyond the territorial limits of recognized government, and (*c*) countries, shall be in accordance with English conventional usage; *e.g.*, (*a*) Sahara, Alps, Danube, (*b*) Bay of Biscay, (*c*) Italy.

(2) In the case of oceanographical features lying outside territorial waters, the descriptive terms entering into their names shall be in English; *e.g.*, Challenger Bank, Dogger Bank, Walfisch Ridge (*not* Walfisch Rücken).

(3) The approved name of any administrative division of a state,* or federation of states, or of any natural or artificial geographical feature or of any place lying wholly within one state, or federation of states, shall be that adopted by the supreme administering authority concerned with that state or federation of states; *e.g.*, Uttar Pradesh (*not* United Provinces), Kaliningrad (*not* Königsberg):

but, should a different name be current in English conventional usage, the latter may be given subordinate recognition; *e.g.*, Cabo de Hornos (Cape Horn), Dhiórix Korínthou (Corinth Canal), Moskva (Moscow).

(4) Where any names of the kinds referred to in Section (3) above contains a descriptive term in a foreign language that term shall not be translated into English; *e.g.*, Cabo de Hornos (*not* Cape de Hornos), Schloss Bellinghoven (*not* Bellinghoven Castle), Isola d'Ischia (*not* Island of Ischia):

but, where a geographical term on a foreign map or chart stands

*For the purpose of applying these principles, the term "state" shall be taken to include an independent country, or colonial territory, or protectorate, protected state, or trust territory.

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in isolation and is neither a geographical proper name nor is attached to such a name, it may be translated; *e.g.*, "bridge" (*not* German "Brücke"), "ford" (*not* Russian "brod").

(5) The names of places and of geographical features in countries which officially use varieties of the Roman alphabet shall be accepted in their official spelling, including the accents and diacritical marks used in the respective alphabets.

(6) The non-Roman letters in the official names of places and geographical features in countries which use partly-Roman alphabets may be transliterated into Roman letters in accordance with the conventions of the respective partly-Roman alphabets.

(7) In countries where the official alphabet of the administering authority is not Roman:

(*a*) where an official Romanization acceptable to the Committee* is in current use the spelling of names shall be in accordance with it.

(*b*) where no official national Romanization exists but a system of Roman transliteration has been accepted by the Committee* for the country under consideration, the official forms of names shall be transliterated in accordance with it.

(*c*) where there is no system of Romanization, or none acceptable to the Committee*, the official forms of names shall be transliterated into the conventional alphabet given below.

(8) In countries where the official script is not alphabetical the official forms of names shall be rendered in Roman letters in accordance with systems of transcription approved by the Committee*, *e.g.*,

China: the Wade-Giles system as modified in 1942
Japan: the Hepburn system as recommended in 1942
Korea: the McCune-Reischauer system.

(9) In those territories where the foregoing Principles may prove to be inapplicable, geographical names should, whenever possible, be recorded in the alphabets officially used for the languages concerned, or be collected in the field by the scientific methods employed for the phonetic recording of speech. Only when these means fail should they be recorded in the conventional alphabet given below.

This system aims at giving a close approximation to the *local* pronunciation; but it is recognised that in some languages, notably Russian, Greek, and Arabic, the necessity for letter-for-letter transliteration often renders this impossible.

*Permanent Committee on Geographical Names

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CONVENTIONAL ALPHABET

Symbol	Range of sound represented

Vowels

a	*a* in *father;* all the sounds represented by *a* in the French words *patte, pas, page, pâle; o* in English *son* or *u* in *cut;* also a shade of the unstressed neutral vowel (see under *ö* below).
e	the first part of the diphthong in *day, e* in French *thé; ai* in *fair, è* in French *père; e* in *bet;* a shade of the unstressed neutral vowel (see under *ö* below).
i	*ee* in *fee, i* in French *si; i* in Italian *via; i* in *sit.*
o	*ou* in *bought, aw* in *law, o* in *not; eau* in French *beau, o* in *rotund.*
ö	*ö* in German *schön, eu* in French *peu; eu* in French *peur, œ* in French *œuf; ea* in *earth* (the last is the stressed neutral vowel in English). The unstressed neutral vowel (the sound of *a* in *marine, e* in *often, u* in *difficult*) is better represented, according to its nearest approximation, by *a* or *e.*
u	*oo* in *boot; oo* in *foot* or *u* in *put* (but not in *but*).
ü	*ü* in German *über, u* in French *lune.*
y	the cavernous vowel, unknown in standard English, represented by *bl* in Russian and by *i* in Turkish. Note that *y* is also used for a consonant-symbol (see below).

Diphthongs

Diphthongs may be represented by combinations of the vowel-symbols given above.

Consonants

b	English *b,* any other sound recognized as a kind of *b* by English ears, as *b* in Spanish *saber.*
ch *or* **c*** (=tsh)	*ch* in *church. c* is established with this value in parts of Africa. *See* Instruction **6**, below.
d	any sound recognized as a kind of *d.*
dh	the soft sound of English *th* in *this, they,* etc.
f	any kind of *f.*
g	*g* in *got* or *gift.*
gh	the soft guttural sound represented by غ (*ghain*) in Arabic, which resembles that of Parisian *r.*
h	(i) the aspiration of vowels (the sounds preceding the vowels in *her hat*). (ii) the aspiration of consonants (emphatic *k, t* and *p* are aspirated in English; *b* is often aspirated in Irish English). In a conventional alphabet it is possible to distinguish between the digraphs (pairs of letters standing for single sounds) *dh, gh, kh, sh, th* and *zh,* and aspirated *d, g, k, s, t* and *z,* respectively, only by means of elaborate devices.
j (=dzh)	in *jib* or *g* in *gem.*
k	any kind of *k*-sound, as *c* in *cat.*
kh	*ch* in Scottish *loch* or German *ach.*
l	*l* in *leave; ll* in *wall; ll* in Welsh *llan.*
m	English *m.*
n	English *n.*
ñ *or* **ny**	as in Spanish *cañón.* Established in many parts of Africa.
ng	*ng* in *singer; ng* in *finger.*
p	any kind of *p.*
q	the guttural sound represented by ق (*qaf*) in Arabic.
r	*r* as sounded in Scotland; any other clearly rolled or trilled *r* sound, like *r* in Spanish *pero.*

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Symbol	Range of sound represented
	Consonants
s	*ss* in *hiss* (but not *s* in *his*).
sh *or* **s***	*sh* in *fish*.
	* *See* Instruction 6, below.
t	any kind of *t*.
th	hard English *th* as in *thistle*.
v	English *v*.
w	English *w*.
x (=ks)	*x* in *extra* (not *x* in *exact*).
y	*y* in *yet*. Note that *y* is also used as a vowel-symbol (see above).
z	English *z* or the *s* in *was*.
zh (*or* **ž**)*	*j* in French *je*; *s* in *measure*.
(')	(inverted comma) The Semetic sound represented by ع (*'ain*) in Arabic; the glottal stop. (In practice the two will not conflict.)
	* *See* Instruction 6, below.

Instructions for spelling in the conventional alphabet

1. Standard native pronunciation is to be taken as the basis for spelling.

2. Each sound is to be represented by its closest corresponding symbol, and a symbol may be doubled only to indicate a clear repetition of the same sound.

3. If their representation be indispensable, a vowel-symbol may be marked with:
   (*a*) an acute accent (') for *stress* (*Kórinthos*—Greece)
   (*b*) a macron (¯) for *length* (*Tōkyō*—Japan)
   (*c*) a tilde (~) for *nasalization* (*Ẹ̀gbā*—Nigeria, *unofficial*).

4. Retroflex, emphatic, implosive or ejective consonants may be indicated by dots beneath the symbols representing them.

5. Palatalization of consonants as in Russian may be indicated by an apostrophe (') after the symbol affected.

6. If it be imperative to distinguish between *sh* and *zh* (the symbols given above) and aspirated *s* and *z* respectively, the alternative symbols *š* and *ž* may be used for the former pair. Similarly, *c* and *ch* could stand for the unaspirated and aspirated " ch " sounds respectively.

7. In the narrow rendering of names in, and their close transliteration into, the conventional alphabet, recommended for textual documents and particularly for gazetteers, the diacritical marks listed in 3, 4, 5 and 6 above, should be used. From the broad rendering in, and broad transliteration into the conventional alphabet, appropriate to maps and charts, these marks may be omitted. (This instruction applies only to the conventional alphabet and has no bearing whatever on No. 5 of the Principles of Nomenclature).

Alphabetical order

The full conventional alphabet consists of the following thirty-seven symbols:

a, b, ch *or* **c, d, dh, e, f, g, gh, h, i, j, k, kh, l, m, n, ñ** *or* **ny, ng, o, ō, p, q, r, s, sh** *or* **š, t, th, u, ū, v, w, x, y, z, zh,** *or* **ž, (')**

but names written in it should be filed or arranged in common English alphabetical order disregarding (').

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LAWS AND REGULATIONS APPERTAINING TO NAVIGATION.

While, in the interests of the safety of shipping, the Admiralty make every endeavour to include in their hydrographic publications details of the laws and regulations of all countries appertaining to navigation, it must be clearly understood:—

(*a*) *that no liability whatever can be accepted for failure to publish details of any particular law or regulation, and*

(*b*) *that publication of the details of a law or regulation is solely for the safety and convenience of shipping and implies no recognition of the international validity of the law or regulation.*

INFORMATION RELATING TO ADMIRALTY CHARTS AND PUBLICATIONS, GENERAL NAVIGATION, AND GENERAL METEOROLOGY.

ON THE CORRECTION OF ADMIRALTY CHARTS.

Guides to Navigation.—In addition to the charts, the navigational publications which are primarily affected by the continual changes and alterations that take place are the Admiralty Sailing Directions, the Admiralty List of Lights, Fog Signals and Visual Time Signals, and the Admiralty List of Radio Signals. The Admiralty Notices to Mariners contain information mainly for the correction of the charts and navigational publications.

CHARTS.

1. **Degree of Reliance.**—It should be clearly understood that the value of a chart depends on the character of the original survey and on the completeness of the report of subsequent changes. The remarks on "The Use of Charts as Navigational Aids, &c." which are subjoined should be carefully studied in this connection.

2. **System of Dating and Issue of Corrected Copies.**— Admiralty charts after first publication are kept corrected by means of new editions, large corrections, and small corrections. Copies of charts issued by the Hydrographic Supplies Establishment, Admiralty Chart Agents or Admiralty Chart Depots are corrected, except from temporary and preliminary Notices to Mariners, for all navigational information to the date of issue.

New Charts.—The date of publication of a chart is shown outside the bottom margin, in the middle, e.g.:—

Published at the Admiralty 30th May, 1947.

New Editions.—When a chart is revised throughout, and modernised in style a new edition is published, the date being shown outside the bottom margin and to the right of the date of publication, e.g.:—

New Edition 2nd Jany., 1947.

All large and small corrections notations are at the same time erased, and all old copies of the charts are cancelled.

Large Corrections.—When a chart is corrected from important information which is too comprehensive to promulgate by Admiralty Notice to Mariners or to insert conveniently by hand on existing

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copies, but when the chart is not revised throughout, the date on which these corrections are made is shown on the chart outside the bottom margin and to the right of the date of publication, and in the case of a chart already marked with a new edition date, below such date, e.g.:—

Large corrections 10th Feb., 1947.

All small corrections notations are at the same time erased, and all copies of the chart are cancelled.

Small corrections.—

(*i*) When a chart is corrected from the information promulgated in an Admiralty Notice to Mariners (except temporary and preliminary Notices), the year, if not already shown, and number of the notice are entered in the bottom left-hand corner of the chart, e.g.:—

Small corrections 1947–*903.*

Copies of the chart stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents and the Admiralty Chart Depots are corrected by hand from such information.

(*ii*) Prior to 1954, when a chart was corrected from information which was considered of no importance from the standpoint of safe navigation, and which was, therefore, not promulgated in an Admiralty Notice to Mariners, the year, if not already shown, and date of the correction were entered on the chart, in one of two ways, in the bottom left-hand corner below the margin and in sequence, with the notations referred to in the preceding paragraph, e.g.:—

Small corrections, 1947—5.20—

or Small corrections 1947—(VI.*25*)

These indicated that the chart plate received minor corrections on the 20th May or 25th June, respectively, which would appear on later printings.

In such cases copies of the chart held by ships and establishments were not usually replaced by new copies, but in exceptional cases, e.g., when new compasses were inserted, new copies of the charts might be supplied. It should, however, be particularly noted that the absence of corrections represented by square or bracket dates from a chart did not invalidate it for navigation.

(*iii*) Since 1954, in order that more attention may be given to New Editions, Large Corrections and corrections by Notices to Mariners, and for other reasons, the making of minor corrections to Chart plates as in (*ii*) has been discontinued. Information of no importance to safe and convenient navigation is instead recorded for inclusion in the next New Edition or Large Correction; or, for promulgation, in a later Notice to Mariners should a change of circumstance alter the importance of the information.

In consequence, the small correction date enclosed in a rectangle does not appear later than 1953 on navigational charts. The date within brackets may still appear and is then an indication that magnetic compasses have been corrected for a change in variation.

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3. Correction of Charts in Ships.—All small but important corrections affecting navigation that can be made to the charts by hand are promulgated in Admiralty Notices to Mariners and, with the exception of corrections from temporary or preliminary Notices, should at once be neatly made in waterproof violet ink on the charts affected, the year (if not already shown) and numbers of the notices being inserted, also in waterproof violet ink, in the bottom left-hand corner of the chart. The recognised abbreviations shown on Admiralty chart No. 5011 ("Signs and abbreviations used on Admiralty Charts") should be used.

Generally speaking, the amount of information which should be inserted on a chart should be in accordance with that already shown.

On large scale charts, the abridged descriptions, as shown on chart No. 5011, of all details of all lights, light-buoys and fog signals, and the year dates of obstructions, reported shoals, dredged channels, depth on bars or in shifting channels, and irregularities of lights, should be inserted.

On coastal charts, the abridged descriptions of only the principal lights and fog-signals, i.e., those to assist in approaching or making the land, should be inserted.

Particulars of such lights should be omitted, in the following order, as the scale of the chart decreases, viz.:—

(i) Elevation, (ii) Period, (iii) Number in Group, and (iv) Visibility.

Particulars of fog signals should be inserted in their appropriate positions if space permits, but should otherwise be entered in a tabulated list under the title or some other convenient place on the chart.

Inner harbour light-buoys and beacons should not be inserted on coastal charts, and against other light-buoys only the character of the light should be inserted.

On ocean charts, lights which are visible 15 miles or over should alone be inserted and then only their character and colour.

On all charts, writing should be inserted as much as possible clear of the water, unless the relative objects are on the water, and care should be taken not to obliterate any information already on the chart. When cautionary or tidal notes, &c., are inserted, they should be written in a convenient but *conspicuous* place, preferably near the title, where they will not interfere with other details.

Erasures should never be made but the details should, when necessary, be crossed through in waterproof violet ink.

Admiralty Notices to Mariners are occasionally accompanied by reproductions of portions of charts (known as "blocks"), and when correcting charts from such blocks the following points should be borne in mind:—

(i) A block may not only indicate the insertion of new information, *but also the omission of matter previously shown.* The latter would, however, invariably be mentioned in the text of the Notice, and the fact that a block accompanies a Notice should not cause the text of the Notice to be disregarded.

(ii) The limiting lines of a block are determined for convenience of reproduction and need not be adhered to when cutting out for pasting on the chart, provided that the point mentioned in the preceding paragraph is taken into consideration.

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(iii) The new information shown on a block can sometimes be inserted on the chart by hand, the reason for issuing a block in such a case being to avoid a long description of the new information in the text of the Notice.

(iv) Owing to distortion the blocks do not always fit the charts exactly, care should therefore be taken when pasting a block on to a chart that the more important navigational corrections fit as closely as possible. This can best be assured by fitting the block while it is dry and making two or three pencil ticks round the edges for use as fitting marks after the paste is applied.

Corrections from Temporary or Preliminary Notices to Mariners should be inserted on the charts *in pencil* and the year and number of the notice should be shown against them, e.g.:—N.M. 625/1947 temp., and also in the bottom left-hand corner of the chart, in pencil, *below* the small corrections notations (*see* above). Temporary corrections should be rubbed out when the notice is received cancelling them, but preliminary corrections should be inked in when the notice is received reporting that the changes have been made.

Charts stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents and the Admiralty Chart Depots are *not* corrected from Temporary or Preliminary Notices to Mariners, and when charts are received from one of these sources they should be corrected in pencil as necessary from the copies of such Notices already held, or from those supplied with the charts.

Corrections from Radio Navigational Warnings concerning derelicts and drifting obstructions, the temporary extinction of lights, displacement of important aids to navigation, ice reports, &c. should also be noted *in pencil*, as received, on the charts affected. Radio Navigational Warnings of a permanent nature and those relating to derelicts and drifting obstructions dangerous to navigation are re-issued in the form of Admiralty Notices to Mariners, but other warnings are not re-issued in this way, except in special circumstances.

Corrections from information received from authorities other than the Admiralty should be noted, *in pencil*, on the charts affected, but no charted danger is to be expunged without the authority of the Hydrographer of the Navy.

NAVIGATIONAL PUBLICATIONS

1. Admiralty Sailing Directions, Supplements, &c.—The Admiralty Sailing Directions, consisting of about 74 volumes for the whole world, contain general information useful to the navigator.

An index chart bound near the beginning of each volume shows the area dealt with and the serial numbers and limits of all Admiralty charts for the area which were published *when the volume was printed.*

Each volume is periodically revised throughout, and, in the intervals between the publication of new editions, Admiralty Notices to Mariners and Supplements are published to enable the volume to be corrected. It should, however be clearly understood that Sailing Directions cannot be correct in all minor details after the date of the latest Supplement.

The above-mentioned corrections are not made in the Sailing Directions stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depots.

A new edition of each volume of Sailing Directions is published at intervals of approximately from ten to twelve years. The number

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of the latest Admiralty Notice to Mariners used in its compilation is given in the "Advertisement" on page iii of each volume, and the numbers of the Notices affecting it between the dates of going to press and issue to ships and establishments are given in the Notice announcing its publication, to enable the new edition to be corrected before being brought into use.

A Supplement to each volume is generally published annually, each succeeding Supplement cancelling the former. When a volume is taken up for revision, however, no further Supplement to that edition is issued, but subsequent Notices to Mariners affecting it are summarised each year and issued as a separate publication, until the new edition of the volume is published.

A tabular form for notation of the existence of Supplements and Summaries of Notices is printed on the front fly-leaf of all Sailing Directions, and these notations are made as necessary in all copies issued by the Hydrographic Supplies Establishment and the Admiralty Chart Depots.

Supplements and Summaries of Admiralty Notices to Mariners should be retained intact. *Whenever reference is made to the Sailing Directions, the Supplement, and where applicable the Summary, must be consulted.* The existence of a Supplement or Summary of Admiralty Notices to Mariners is to be entered in the tabular form inside the cover of the Sailing Directions. New and amended information appearing in the Supplements for the first time is indicated by square brackets, and deletions from the previous Supplement are indicated by horizontal lines.

Admiralty Notices to Mariners affecting Sailing Directions *are not* to be cut up and pasted in, but the book is to be annotated in the margin, or corrected in manuscript, as convenient.

2. The Admiralty List of Lights, Fog Signals and Visual Time Signals.—The Admiralty List of Lights, Fog Signals and Visual Time Signals for the world is issued in twelve volumes divided geographically as shown on the index chart at the beginning of each volume.

Light-buoys are *not* included in the list.

The volumes are published annually at the rate of one volume per month; however, if there are insufficient corrections to justify the publication of a new edition of any volume, this will be notified by Notice to Mariners.

Each volume will be issued with an inscription on its cover and title page stating the date to which the volume has been corrected, which will be approximately eight weeks prior to the date of its issue. Corrections or additions to each volume, which may occur between the date of correction and date of issue, will be promulgated by Section III of the Weekly Edition of Admiralty Notices to Mariners announcing the publication of the new volume.

Amendments.—Important amendments are promulgated in Admiralty Notices to Mariners. In Section III of each Weekly Complete Edition of these Notices will be found additions and alterations made to Lights, Fog signals and Visual Time Signals by the Notices issued during the week affected; this section also includes other amendments, particularly amendments of a Temporary nature, which have not yet necessitated or will not necessitate the issue of a Notice to Mariners.

Corrections to the Light Lists may be extracted from Section III and pasted in the appropriate volume.

Note.—Corrections are not made in copies of the Lists of Lights, &c.,

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stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depots, and copies received from these sources should accordingly be corrected from the weekly editions of the Notices to Mariners before being brought into use.

3.—The Admiralty List of Radio Signals.—The Admiralty List of Radio Signals is issued as follows:—

Volume I.—Communications—Comprises particulars of radio-telegraph coast stations, together with general regulations; it also includes such subsidiary services as medical advice supplied by radio, distress signals and details of Air-Sea Rescue Organisation.

Volume II.—Navigational Aids—Comprises particulars of services from direction-finding stations and radiobeacons including air radiobeacons useful to ships; also stations giving QTG service and calibration stations; all relevant codes and regulations will be found in this volume.

Volume III.—Meteorological Services—Comprises particulars of weather services provided for the use of shipping, together with relevant codes.

Volume IV.—Meteorological Observation Stations.

Volume V.—Comprises particulars of Radio time signals, Uniform time system, navigational warnings and Position fixing systems (Decca, Loran, Consol, etc.).

New editions of each volume will normally be published annually. All corrections subsequent to the date of publication are promulgated in Section VI of the complete weekly edition of Admiralty Notices to Mariners.

Copies of the List stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depots are not kept corrected, and Lists received from these sources should accordingly be corrected from the weekly editions of the Admiralty Notices to Mariners before being brought into use.

4. The Admiralty Tide Tables.—The Admiralty Tide Tables are published in three volumes as follows:—

Vol. I. "EUROPEAN WATERS (including Mediterranean Sea)".
Vol. II. "ATLANTIC AND INDIAN OCEANS."
Vol. III. "PACIFIC OCEAN AND ADJACENT SEAS."

Each volume contains two parts; Part I giving tidal predictions for Standard Ports and, in Vols. II and III, tidal stream predictions for certain straits and channels; Part II gives data for predicting tides at Secondary Ports.

THE USE OF CHARTS AS NAVIGATIONAL AIDS AND GENERAL REMARKS RELATING TO PRACTICAL NAVIGATION.

(1) Reliance on a chart.—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger the scale of the chart.

To estimate this the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circum-

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stances that precluded great accuracy of detail, and, until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

It appears to be insufficiently realised that the degree of reliance which may reasonably be placed upon an Admiralty chart, even in surveys of modern date, is mainly dependent on the scale on which the survey was made. The scale for publication is now generally that of the original survey, except in the case of coast sheets which are sometimes reduced. It should not, therefore, be assumed that the original survey was made on a larger scale than that published.

It must be borne in mind that the principal method of ascertaining the inequality of the bottom of the sea is by the laborious process of sounding, and that in sounding over any area, the boat or vessel obtaining the soundings is kept on given lines; that each time the lead descends, or a sonic sounding is taken, the depth over only a small area is obtained, in the case of the lead, it has a diameter of only a few inches, and that consequently each line of soundings, though miles in length, is only to be considered as representing a narrow width.

Surveys are not made on uniform scales, but each survey is made on a scale commensurate with its apparent importance. For instance, a general survey of a coast which vessels only pass in proceeding from one place to another is not usually made on a scale larger than one inch to the nautical mile, while surveys of areas where vessels are likely to anchor are made on a scale of three inches to the mile, and surveys of frequented ports or harbours likely to be used by fleets, on a scale of from six inches to ten inches to the nautical mile.

Close examination by sounding is the only method by which surveys on a large scale can be made, and in view of the vast mileage of surveys yet requiring completion in the interests of navigation, it would be a waste of time to undertake large scale coast surveys.

The scale on which a survey is to be conducted having been settled, it is manifestly superfluous to obtain more lines of soundings than can be represented on the paper. 100 soundings, which is the maximum number that can be placed with clearness on every square inch of paper, means that on a scale of one inch to the mile each sounding on the chart occupies an area representing eight acres of actual ground, whilst on a scale of six inches to the mile each sounding represents an area of a little less than a quarter of an acre, i.e., of 100 feet square.

The following diagram represents as many soundings as can be placed legibly on a square inch of paper:—

16	15	15	13	13	14	12	11	10	9
14	15	14	14	13	13	12	11	9	8
15	15	14	17	16	14	13	10	10	9
16	16	17	18	16	12	11	8_5	9	10
18	17	15	12	9	7_3	7_4	7_4	9	10
19	16	12	9	5_3	4_4	5_4	6_4	8_5	9
22	19	16	10	3_4	5_1	6_1	7_3	8_3	10
20	16	12	7_1	5_4	6_1	6_4	7_1	8_3	10
18	15	11	9	7_3	7	7_3	8_3	10	11
20	17	14	11	12	10	9	10	11	13

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Little assistance in detecting excrescences on the bottom is afforded by the eye, when sounding in a boat, even in clear water, on account of the observer being within five feet of the surface; none in turbid seas. If, therefore, there is no inequality in the soundings to cause suspicion, a shoal patch between two lines may escape detection.

Thus, in a chart on a scale of one inch to the mile, an inequality of some acres in extent rising close to the surface, if it happened to be situated between two lines, might escape detection; whilst in a chart on a scale of 6 inches, inequalities as large as battleships, if lying parallel with, and between the lines of soundings, might exist without detection if they rose abruptly from an otherwise even bottom.

General coast charts should not, therefore, be looked upon as infallible, and a rocky shore should on no account be approached within the ten-fathom contour line, without taking every precaution to avoid a possible danger; and even with surveys of harbours on a scale of 6 inches to the mile vessels should avoid, if possible, passing over charted inequalities in the ground, as some isolated rocks are so sharp that the lead may not find the highest part. Better results can, however, be obtained by sonic sounding owing to the rapidity with which such soundings can be taken, but even this method will not find rocks unless the boat or vessel be directly over them.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion.

Soundings in hair line, which are shown on the latest charts in upright figures, and on other charts in sloping figures, indicate that such soundings have been taken from smaller scale charts, an unreliable source, or adapted from old and imperfect surveys.

(2) **Fathom lines a caution.**—Except in plans of harbours that have been surveyed in detail, the six-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for such a detailed survey. It is not contemplated that ships will approach the shore in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, as before mentioned, another warning, especially for ships of deep draught.

Charts on which no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided as there is no knowing how closely the spot may have been examined.

(3) **Chart on largest scale always to be used.**—It sometimes happens that from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive re-arrangement of coastline or sounding. This is an additional reason,

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besides the obvious one of the greater detail shown, why this largest scale chart should always be used for navigating.

(4) Caution in using small-scale charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

(5) Graduation.—All plans are now being graduated in skeleton style before publication in order to facilitate easy reference to geographical positions; previously published plans are also graduated as opportunity offers. The graduation is, however, of necessity often based upon imperfect information of a conflicting nature; for this reason, whenever a geographical position is quoted other than approximate (i.e., when seconds are given), it is necessary to quote also the number of the particular chart from which the position has been derived.

In this connection it is pointed out that, whenever possible, a position should be transferred from one chart to another by bearing and distance from a distinguishing feature common to both, such as a point of land or a light, &c., and not by the graduation which may differ owing to one of the charts being constructed on later and more complete geographical data than the other.

(6) Distortion of printed charts.—The paper on which charts are printed is, from various causes, subject to distortion, but the effect of this is seldom sufficient to affect navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted upon the chart, especially if the lines are to objects at some distance. The larger the chart the greater the amount of this distortion.

(7) Buoys.—It is manifestly impossible that any reliance can be placed on buoys always maintaining their exact position. Buoys should, therefore, be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings of fixed objects on shore or angles between them, and not by buoys.

(8) Light-buoys.—The lights shown by light-buoys cannot be implicitly relied on, as, if occulting or flashing, the apparatus may get out of order, or the light may be altogether extinguished. These lights in the British isles are from 5 to 217 candle-power.

(9) Cable-buoys.—Cable-buoys marking the ends of submarine cables usually are spherical or can-shaped, surmounted by a globe and occasionally a flag. Below the topmark two *white fixed* lights, disposed horizontally, may be exhibited, but they cannot be implicitly relied on.

(10) Lights.—Arcs drawn on charts round a light are not intended to give information as to the distance at which it can be seen, but solely to indicate, in the case of lights which do not show the same characteristics or colours in all directions, the bearings between which the differences occur.

All the distances given in the Admiralty List of Lights and on the charts for the visibility of lights are calculated for a height of an

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observer's eye of 15 feet. The table of distances visible due to elevation, at the beginning of each volume of the Admiralty List of Lights, affords a means of ascertaining how much more or less the light is visible should the height of the eye be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its candle power, as given in the Admiralty List of Lights, and in some cases by noting how much its visibility in clear weather falls short of the range due to the elevation at which it is placed. Thus, a light standing 200 feet above the sea, and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its elevation would permit it to be seen over 20 miles, if of any power. (*See* table in the Admiralty List of Lights.)

The distance from a light cannot be estimated either by its brilliancy or its dimness.

On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip it may be determined whether the vessel is in the circle of visibility corresponding with the usual height of the eye or unexpectedly nearer the light.

(11) **Fog signals.**—Sound is conveyed in a very capricious way through the atmosphere. The following points in regard to fog signals should be borne in mind:—

(*a*) Fog signals are heard at greatly varying distances.

(*b*) Under certain conditions of atmosphere, when an air fog signal is a combination of high and low tones one of the notes may be inaudible.

(*c*) There are occasionally areas around a fog signal in which it is wholly inaudible.

(*d*) A fog may exist a short distance from a station and not be observable from it, so that the signal may not be sounded.

(*e*) Some fog signals cannot be started at a moment's notice after signs of fog have been observed.

Mariners are therefore warned that fog signals cannot be implicitly relied upon, and that *the practice of sounding should never be neglected.* Particular attention should be given to placing "Look-out men" in positions in which the noises in the ship are least likely to interfere with the hearing of the sound of an air fog signal; as experience shows that, though such a signal may not be heard from the deck or bridge when the engines are moving, it may be heard when the ship is stopped, or from a quiet position. It may sometimes be heard from aloft though not on deck.

Great assistance may be obtained from radiobeacons at many important lighthouses and light-vessels, but the attention of Mariners is called to the serious dangers which may arise from their misuse. No attempt should be made to approach such a position on a radio bearing, whilst relying on hearing the sound fog signal in sufficient

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time to alter course to avoid danger. When the radio fog signal is transmitted from a light-vessel, it is essential in order to avoid collision, that the bearing from the light-vessel should not be kept constant.

(12) Tides.—In navigating coastal waters where the range of the tide is considerable, caution is always necessary. The tidal predictions for Standard ports in the Admiralty Tide Tables can generally be relied upon to give the times of high and low water to within a few minutes, and heights within a few tenths of a foot. Larger errors are to be expected in the predictions for places which are not Standard ports, computed from the data in Part II, but such predictions computed from the harmonic constants are always sufficiently accurate for the general requirements of navigation. For Standard ports the heights of the tide at times between high and low water may usually be found within narrow limits in accordance with the instructions in the Tide Tables.

The datums of Admiralty charts depending on Admiralty surveys vary with the type of tide, but usually conform with the International agreement, that datum should be "a plane so low that the tide will but seldom fall below it." The datums used by different nations, however, differ very considerably and those of Admiralty charts depending on foreign surveys are always those used by the original surveyors, which vary from "lowest possible low water" to "mean low water" in tidal waters, and are usually mean sea level in non-tidal waters.

The datum used is always stated on large-scale Admiralty charts.

Caution.—Most datums are above the lowest level to which the tide may fall; the charts therefore do not always show minimum depths.

(13) Tidal streams.—Where the tidal streams are semi-diurnal information regarding them is usually given, in a convenient part of the chart, in tabular form or by notes, special symbols being inserted at the positions to which the information refers. In certain cases, where the information available is incomplete, the streams are indicated by means of arrows.

There are many places where the tidal streams cannot be predicted by reference to the tide at a Standard port. Although no data for predicting the times at which they flow is given, their general direction is, in many cases, indicated by arrows on the charts. For a few of the straits and channels, where these conditions exist, tidal stream predictions are given in Admiralty Tide Tables.

Tidal streams, particularly if rotary, may vary considerably both in direction and rate; predictions of the stream must therefore always be considered approximate.

The turn of the tidal stream is not usually coincident with the times of high and low water; in fact, though in estuaries, harbour entrances, &c., the stream usually turns at about the times of high and low water, in open channels, and along open coasts generally, the turn usually occurs more nearly at half-tide. Predictions of the times of high and low water must therefore never be used as predictions of the times of slack water.

It should be remembered that, even where the general direction of the stream is parallel with the shore, an indraught is usually experienced when crossing the entrances to bays and inlets.

(14) Fixing positions.—For further information on this subject, *see* Admiralty Manual of Navigation.

When in sight of land, every opportunity should be taken of fixing the ship's position by terrestrial objects.

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(*a*) *Simultaneous bearings or angles.*—The most usual method is by compass bearings of suitable objects, and it must be borne in mind that a fix by only two bearings is liable to error, either an absolute error in taking the bearings, or those made in applying the deviation or in laying the bearings off on the chart. For these reasons, a third or check bearing of some other object should, when possible, be taken, especially when near the shore or dangers. The coincidence of the resulting three lines will prevent any mistakes if the objects are suitably placed.

The position may also be fixed by observing horizontal sextant angles of well-defined suitably placed objects. These angles may be plotted on the chart with a station-pointer. Two conditions are, however, necessary to its successful employment; first, that the objects be well chosen; and, second, that the observer is skilful and rapid in his use of the sextant and station-pointer. For the former, reference can be made to the pamphlet on the use of the station-pointer, or to the Admiralty Manual of Navigation; the latter is only to be obtained by practice.

It will readily be seen that a sextant often offers advantages, as angles can be obtained from any position whence the objects are visible, and the fix is in no way dependent on the compass.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud-banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

In all cases where great accuracy of position is required, such as the fixing of a rock or shoal, or the addition to a chart of fresh soundings or new buildings, angles should invariably be used. In such cases angles should be taken of a number of objects, five being a good number, since this not only fixes the position beyond doubt, but also affords a useful check on the accuracy of the chart itself. When running a line of soundings it is only necessary to take a third angle every now and then, firstly to make certain that the more important soundings, as at the end of a line, are correctly placed, and secondly to check the general accuracy of the chart.

Sometimes when only one of the selected objects is visible from the compass, a compass bearing of it and a sextant angle to the other may be used to fix the position.

(*b*) *Simultaneous bearing and distance.*—Attention is also directed to the very useful and handy method of fixing by the bearing and distance of a suitable object.

Should the ship be supplied with ranging equipment, its use here is obvious, but without it a very good approximate distance of an object of known height may be obtained by observing its angle of elevation and obtaining its distance from Lecky's Offshore Distance Tables, which are supplied with all sets of charts. Full directions for the use of these Tables are given with them.

(*c*) *The running fix.*—If two position lines are obtained at different times the position of the ship may be found by transferring the first position line up to the time of taking the bearing for the second position line. The point of intersection of the second and the transferred position line is the ship's position at the time of the second observation.

The accuracy of this fix will depend on the accuracy of the estimated run (over the ground) between bearings and, therefore, it is essential

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to take great care that an accurate allowance is made for tidal stream, current, and leeway experienced by the ship during this interval.

The method of fixing by doubling the angle on the bow is useful when passing points of land, &c., in waters where there is either no tidal stream or current, or where this can be estimated with sufficient accuracy.

This method is as follows:—

Suppose that the angle between the ship's head and an object is measured, and found to be X°, and that the time of the observation is noted. Suppose also that the time is again taken when the angle between the ship's head and the object is 2X°. Then, if the course made good is the course steered, the distance of the ship from the object at the time the second bearing was taken is equal to the run (over the ground) in the interval. Hence the ship's position can at once be laid off as a bearing and distance from the object. In practice the angle X should not be less than about 25°.

The most usual form of this method, the so-called "four-point" bearing, gives a good fix for a departure, but does not ensure safety, as the point and any dangers that may lie off are abeam before the position is obtained.

The above fix is reliable when there is no tidal stream or current or when it runs directly with or against the course of the ship. When the stream or current runs across the course of the ship or when leeway is to be allowed for, this method should never be used and the ship's position should be obtained by plotting the two bearings as a running fix.

A table "Distance of an object by two bearings" is supplied with certain chart folios, and is also given in Inman's Tables, by which the ship's position at the second bearing can be found: any two bearings at a suitable angle to each other may be used, together with the run between them, but again, this table should not be used when the vessel is subject to a cross tidal stream or leeway.

(*d*) *The danger angle.*—The use of the danger angle in passing outlying dangers with land behind them should also not be forgotten.

A vertical danger angle is useful when the danger lies off an object such as a lighthouse, the height of which is known; the angle being obtained from the aforesaid Lecky's Tables. If a horizontal danger angle between two objects is used, however, caution is necessary, as, should the objects not be correctly placed on the chart, the angle taken from it may not serve the purpose. This method should not, therefore, be employed when the survey is old or manifestly imperfect.

(*e*) *The astronomical position line.*—When fixing by astonomical observations, attention is drawn to the great utility of the position line. Even a single position line may at times give invaluable information as the ship must be somewhere on this line, provided that the chronometer error is accurately known.

A sounding obtained at the same time may often serve to give an approximate position. Again, by steering along, or at a required distance parallel to, a single position line, a vessel may make her port or avoid a danger, although uncertain of her position.

A very accurate position may be obtained by observations of three or more stars at evening or morning twilight, or by the observation of a bright star at daybreak and another shortly afterwards of the sun when a few degrees (not less than 10°) above the horizon. The position lines obtained from the bodies observed should differ in azimuth by 30° or more.

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Mariners are also reminded that, with modern tables for correcting the altitude, observations of the moon entail practically no more calculation than those of a planet. Moon sights are sometimes available when stars are obscured by light cloud, &c.; also, an excellent position may frequently be obtained by simultaneous observations of the sun and moon.

(*f*) *The radio position line.*—A number of radio systems of which the principal ones are M/F D/F, Radiobeacons, Consol beacons, Loran, Gee and Decca, are now in general use from which position lines or fixes may be obtained.

The accuracy and range which may be obtained from these systems vary considerably; their great advantage over other methods lies in the fact that they can be employed under all weather and visibility conditions, though in some cases the results obtained will vary between day and night.

Special receiving equipment is generally required in order to make use of the radio signal, and some systems require special lattice charts or tables for plotting the position lines. Full details of these systems and their coverage areas are contained in Admiralty List of Radio Signals, Volumes II and V.

The mariner should appreciate that with the position-fixing systems the accuracy of a fix will depend on three factors:—

(i) The distance of the observer from the transmitters.

(ii) The bearing of the observer from the base line joining the pair of stations which he is using.

(iii) The angle of intersection of the hyperbolic position lines.

It should be apparent from the inspection of any lattice chart that an inherent small equipment error, or a small personal error that may occur at the receiver, will cause a geographical error of varying amount according to the observer's position.

It is important to realise that accurate equipment is no guard against the vagaries of the propagation of radio waves. The beacons and systems operating on medium and low frequencies are liable to "night error" in areas where the ground and sky waves are received with equal strength; these areas will occur at ranges depending upon the particular frequency used by any beacon or system. Where the transmissions of two stations are synchronised to provide one signal reading and position line, "night error" will be a minimum along the normal to the base line joining the pair of stations, and a maximum towards the limits of their service sector.

Little is yet known about the effects of hills and discontinuities in the terrain (such as cliffs) on the speed of medium- and low-frequency radio waves.

At the other end of the radio spectrum the transmissions of systems operating on the very high frequencies are subject to distortion in abnormal atmospheric conditions.

(*g*) *Fixing by radar.*—Radar may also be of assistance when navigating in coastal waters in low visibility or at night. It is essential, however, to appreciate the limitations of a radar set when interpreting the information obtained from it. It must be remembered that the radar sea horizon is, under normal radio propagation conditions, only slightly farther than the visual sea horizon with the eye at the same height as the radar aerial. No echoes will be received from a coastline lying beyond and below the radar horizon, but they may be received from more distant high ground; this may give a misleading impression of the range of the nearest land.

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Abnormal propagation conditions, which often occur in tropical regions, can produce a pronounced increase in detection ranges whilst the opposite, a decrease in detection ranges, sometimes occurs in higher latitudes.

The best fixing accuracy will be obtained by using isolated objects such as detached lighthouses, rocky islets, the extremities of long piers or jetties, or such features as steep cliffs.

Bearing and Range accuracy.—The possible errors in the measurement of bearing and range must be taken into account when using radar for position fixing. In modern 3 cm. radar equipments the minimum bearing error is likely to be one degree for echoes near the edge of the display and the minimum range error $2\frac{1}{2}\%$ of the maximum range of the scale in use or 75 yards, whichever is the greater.

The width of the radar beam in the horizontal plane has the effect of drawing out the edges of the echoes of targets; if this is not allowed for, errors up to a maximum of one degree ($\frac{1}{2}$ beam width) may result. When taking a series of bearings on the same echo, care is necessary to ensure that the same part of the echo is used. Except when using gyrostabilised displays, great care is necessary to allow for 'yaw'.

The greatest accuracy of range and bearing measurement will be obtained if the range-scale is selected so that the echo under observation is in the outer half of the display.

Identification of coastal features.—The identification of coastal features is dependent on their configuration. Reflection of radar energy is very similar to that of light waves and hence curved or sloping surfaces will not give as strong a radar echo as abrupt faces such as steep cliffs; moreover, the appearance of the echo may vary considerably with the bearing. It is difficult to identify any portion of flat or gently shelving coastline such as mud-flats or dunes (*see* Appendix No. III, Reported Radar Ranges).

Range of detection is improved and identification is assisted in some areas by the fitting of radar reflectors to objects such as buoys. Attention is drawn to the symbols with which such objects are marked on Admiralty charts and which are given in the latest edition of chart No. 5011—"Explanation of signs and abbreviations used on Admiralty charts".

More positive identification may, in the future, be obtained from "Racons" which are self-contained transmitter/receivers situated on shore or on navigational marks, whose function is to receive ships' radar transmissions and to transmit a return signal which will be displayed on the ship's PPI at the range and bearing of the Racon.

Radar stations providing navigational assistance.—Details concerning certain shore-based radar stations which render navigational assistance to ships are given in the Admiralty List of Radio Signals, Volume II.

(15) Observations for errors of the compass.—No opportunity should be neglected for checking the error of the compass. When coasting, and a well-surveyed and fairly large-scale chart is available, an excellent method of observing the error is by taking the compass bearing of two suitable objects when in transit, and comparing this with the chartered bearing; there should be sufficient distance between the objects to provide a sensitive transit. When this method is not available the error should be obtained by azimuths of a heavenly body. Errors should be observed on any change of course on which the ship is steadied for a reasonable time, and at least twice a day when steering a steady course for long periods.

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(16) Change of variation of the compass.—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are re-engraved when the error amounts to a degree, but the chart plates cannot be corrected more frequently from the impossibility of making alterations often on one spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles, and in the English channel about 5° in 400 miles. The Variation chart should be consulted on this head.

On certain general charts embracing large areas with considerable change of variation, true compasses are placed instead of magnetic compasses, the variation being shown by *isogonic lines* (curves of equal magnetic variation), in a similar manner to the Variation chart. One or two *isogonic lines* are also sometimes placed on charts, in addition to the magnetic compasses, in order to indicate the general direction of these curves, and thus facilitate the determination of the variation to be employed in portions of the chart not in immediate proximity to any one of the engraved compasses. Magnetic variation values shown on Admiralty charts are for the 1st July of the year mentioned, prior to 1955, and for 1st January subsequent to that year.

(17) Local magnetic disturbance of the compass on board ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places on the globe. Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such a rapid proportion as the distance from it increases that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic ores in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together. Such areas are depicted by a special symbol on charts, and the cause of the magnetic disturbance is referred to as a Local Magnetic Anomaly.

They may also be due to wrecks lying on the bottom in moderate depths, but investigations have proved that, while deflections of unpredictable amount may be expected when very close to such wrecks, it is unlikely that deflections in excess of 7° will be experienced, nor should the disturbance be felt beyond a distance of 250 yards.

It is very desirable that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

(18) Use of oil for modifying the effect of breaking waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied,

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may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:—

1. On free waves, i.e., waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, both when running, or lying to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.

At anchor, when the sea is sufficient to render it difficult to hoist up or in boats, oil bags from forward or from the swinging booms have been found to render the sea alongside comparatively smooth.

7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be: hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the depth of the water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

12. Towing a vessel in a heavy sea, oil is of the greatest service, and may prevent parting the hawser. Distribute from the towing vessel forward and on both sides; if used only aft the tow alone gets the benefit.

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(19) Mirage and abnormal refraction.—An unusual lapse rate of temperature (and therefore density as well) with height immediately above the sea (or land) surface produces a distortion in the appearance of objects near the horizon; such a phenomenon is known as mirage.

When the surface is relatively cold (and the wind very light) so that the density of the air decreases rapidly for a short distance above the surface, light rays from objects low down near the horizon are bent down, the same way in fact as are usually the rays of the sun when entering the earth's atmosphere at a low altitude. The effect is to render visible objects that are normally below the horizon, e.g., lights may be "raised" at night at much greater distances than one would ordinarily expect. This phenomenon is known as "looming."

A further occasional effect produced when the air is appreciably warmer than the sea, is "superior mirage" in which an inverted image is seen over the real object; sometimes an erect image is seen immediately above and touching the inverted one. The object and its images in this instance are well defined in contrast to the shimmering object and image of the inferior mirage. Superior mirage is most often experienced in high latitudes and wherever the sea surface temperature is abnormally low.

"Inferior mirage", the effect of which is to decrease the distance at which objects are visible in a horizontal direction, is due to a rapid increase of density with height close to the surface such as occurs when air of comparatively low temperature blows over a warmer sea, or over a tarred road or desert when a hot sun is beating down on it. In either event light rays are bent up when approaching the surface where the density of the air is much less than above. The coastline, and at times a ship or island, may appear to be floating in air above a shimmering horizon, possibly with, in the former instance, her hull either invisible or with an inverted image underneath. Inferior mirage is comparatively uncommon at sea and is more likely to be observed along a coastline than well out to sea.

When mirage is evident caution must be used in taking sights with a sextant, for abnormal refraction must necessarily be present also. With inferior mirage better, but not normal, results will usually be obtained by ascending as high as possible in the ship; with superior mirage the height of eye should be as low as possible. It is, however, advisable, whenever abnormal refraction is suspected, to measure the elevation of the celestial body above the back as well as the front horizon as explained in navigational text-books.

(20) Aurora.—The most common form of aurora is an arc system, single or multiple, narrow and well defined, or broad and diffuse, and centred on the magnetic meridian.

The most usual colour is pale whitish green when the auroral activity is weak and diffuse: but when the aurora arises high towards the zenith in the form of rays, rayed curtains and draperies with much rapid movement of the constituent rays, the colours sometimes become much stronger and more vivid, and include bright green, red and violet. When the curtains forming the aurora converge to form a corona, which may rotate very rapidly about the point of convergence, the displays may become very complex, filling practically the whole sky, and extending far to the equatorial side of the zenith with much rapid movement and change of colour from instant to instant.

Though the most usual duration of auroral displays in these high latitudes is several hours, they not infrequently last throughout the whole night from dusk to dawn. In such long displays the really

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intense and violently active periods with vivid strong colours are generally confined to spasms of 15–30 minutes, with the intervening periods filled with diffuse glows or quiet arc systems.

The absolute intensity of the light of the aurora is seldom great, and the brighter stars usually glimmer through it. In the most vivid and intense displays, the light may equal, but rarely surpasses, that of the full moon in a cloudless sky. It may give enough light to read by. On such occasions the aurora may be visible to some extent in partial twilight.

Though in high altitudes aurora occurs any time in the dark hours it is probably most frequent in the late evening hours from 9 p.m. till midnight or just after; it is more frequent in the equinoctial months than at other times and has a well-defined 11-year period of activity following the cycle of solar activity. A maximum of activity occurred in 1948, and the interval from maximum to minimum activity usually occupies a period of about 6 to 7 years. In high latitudes this cycle of activity is reflected more in the intensity and vividness of the displays than in the frequency of occurrence. Though really outstanding displays tend to occur around the years of maximum activity they may occur at any time of the cycle, except perhaps near the absolute minimum.

In addition to this 11-year cycle of activity active periods tend to recur at intervals of 27 days, *see* Magnetic Storms.

Northern hemisphere.—Aurora Borealis occurs most frequently along a zone which forms an approximate oval, of average radius 23°, with centre in the extreme north-west of Greenland. This zone of maximum frequency crosses Hudson Bay and the Labrador coast in about lat. 58° N. It runs south of Cape Farewell and along the south coast of Iceland. It lies just north of North Cape, touches the extreme north of Novaya Zemlya, skirts Cape Chelyuskin and then eastward just north of Wrangel Island into the north of Alaska. Along this zone aurora of some kind can probably be seen every suitable night when the sky is clear; 250 miles outside this maximum zone to the southward the auroral frequency decreases sharply to about 70–100 nights a year on the average, and to 20–25 nights 500 miles south of the maximum zone. Inside the maximum zone the geographical distribution of frequency is not so well established but it probably falls off more gradually than it does outside.

On the zone of maximum frequency itself aurora appears as frequently to the south of the zenith as to the north, but with increasing distance outside the zone the appearances concentrate more into the northern sky; the reverse is true inside the zone.

Southern hemisphere.—The frequency and distribution of Aurora Australis is not fully known. It is probable that it is more frequently seen at sea between about long. 50° E. and 175° W. than in other longitudes. Very fine displays have occasionally been seen in Australasia and on passages across the Southern Ocean. There is nevertheless a general impression that aurora is less frequent in the southern than in the northern hemisphere. This is probably to be accounted for by the fact that, apart from whaling and exploring expeditions, ships' tracks in general do not extend to such high latitudes as in the northern hemisphere.

The zone of maximum auroral frequency is roughly annular and is near the circumference of a circle of radius about 1,080 miles, centred in about lat. 75° S., long 129° E. The frequency falls off both outside and inside this zone. A large part of the zone is within the continent of Antarctica.

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(21) **Magnetic storms.**—Magnetic storms vary in intensity and frequency with the sunspot cycle, similarly to aurorae. An intense magnetic storm is always accompanied by a bright and active aurora. The deeply coloured aurorae, showing more pronounced red and green, and sometimes also blue and violet, tints, are invariably connected with magnetic storms of considerable or great intensity. Such a storm will produce simultaneous aurora in both hemispheres. In the greatest storms aurorae in some form may be visible down to about 20° north latitude in certain parts of the oceans, especially between the meridians of 30° W. and 140° W. Magnetic storms vary greatly in duration from a few minutes to several days; they are generally more intense during the hours of darkness. Long-continued storms usually show great fluctuations with periods of complete or partial quiescence. Similarly the associated aurora fluctuates between active and quiescent forms.

The origin of magnetic storms and aurorae is not yet fully understood, but they are intimately connected with the state of a local area of the sun. As the same part of the sun is again presented to the earth after an interval of about 27 days, a magnetic storm and aurora may recur at this time, usually in less intense form.

A ship's compass may tend to deviate during the progress of a considerable magnetic storm. In more intense storms the compass needle may oscillate 1° or more either side of its normal position. Such oscillation may persist for as long as 10 or 20 minutes before dying out. Further oscillation may occur after a period of quiescence. Deviations of 2° or more are rare, but during the great magnetic storm and aurora of January 25th, 1938, one of 4° to the eastward was observed off the Portuguese coast. During a severe magnetic storm the compass may be deflected continually in one direction to the extent of about half a degree for some hours. When bright aurora is seen, especially if it is of the more deeply coloured and rapidly moving kind, and particularly when it is observed in low latitudes, the possibility of deflections of the compass should always be borne in mind.

During a considerable magnetic storm freak radio reception may occur on certain waves and short-wave transmission may fade to complete silence. Beam radio communication, especially in a west-east or east-west direction, may be interrupted. Such conditions may last in some degree over a period of several days, at times when the sun is usually active. Short-wave fading also occurs occasionally from a different form of solar disturbance known as a "bright eruption," when this is very intense. On the average such fading begins about 7 minutes after occurrence of the bright eruption and may last 5 or 10 minutes, gradually returning to normal within a period of 40 to 45 minutes. These fadings are confined to the daylight hemisphere of the earth, while the magnetic storm fadings may occur by day or by night.

GENERAL METEOROLOGY.

(All the following articles do not apply to every Pilot, but articles applicable to this Pilot will be referred to in the Climate and Weather Section in Chapter I.)

(1) **Lows.**—A low, or depression, appears on a synoptic chart as a series of isobars roughly circular or oval in shape, surrounding an area of low pressure. It is a main feature of the weather at sea in

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middle latitudes where it is responsible for most of the occasions of strong winds and unsettled weather, though not all depressions are accompanied by strong winds.

Lows vary very much in size and depth; one may be only a hundred miles in diameter and another over two thousand miles; some are deeper than others, a deep low being one in which the pressure is very much lower near the centre than on the outside whereas, on the other hand, a shallow depression is one where the pressure, although low near the centre, is not very much lower than in the surrounding districts.

Note.—The bracketed equivalents hereunder refer to the Southern Hemisphere.

In the northern (southern) hemisphere the winds blow round an area of low pressure in an anti-clockwise (clockwise) direction; there is also a slight inclination across the isobars towards the lower pressure. Thus the well-known rule for the northern (southern) hemisphere is that when an observer faces the wind the direction of the lowest pressure is from 8 to 12 points to his right (left). The strength of the wind is in all instances closely related to the steepness of the barometric gradient or distance apart of the isobars; the closer the isobars the stronger the wind.

Lows may move in almost any direction, though most often towards north-east (south-east) or east, at a speed of anything between 10 and 40 knots, though occasionally as much as 60, during the middle and most active stage of their existence; they slow down when filling up (*see* "occlusion" below). The life of a low is in the region of 4 to 6 days.

There are usually one or more fronts, probably radiating from the centre, in the area covered by a low; each front on a synoptic chart represents a belt of relatively bad weather, accompanied by a veer (backing) of wind, which marks the change from the weather characteristic of one air mass to that of another. During the first two or three days of its life a low has a warm and a cold front, the area between the two being known as a warm sector because the air has come from a warmer locality than that which is outside the sector (*see* Fig. 1*a*). Warm air is lighter than cold air and it rises over the cold air ahead of the warm front as shown in Fig. 1*b*; this causes condensation of the water vapour in the warm air, forming at first cloud and later drizzle or continuous steady rain. The cloud spreads out ahead of the warm front, and the highest cloud, cirrus or mares' tails, is often about 500 miles ahead. At the rear boundary of the warm sector, known as the "cold front", the cold air is pushing under the warm air forcing the latter to ascend rapidly; this process is sometimes violent enough to produce squalls. The rapid ascent of the warm air causes the moisture to condense in the form of cumulo-nimbus clouds (shower clouds), from which heavy showers may fall. The cold front gradually overtakes the warm front so that the warm sector is eventually lifted up from the earth's surface. When this has occurred the low is said to be occluded, and the warm and cold fronts have merged into the third type of front known as an "occlusion" (*see* Figs. 2*a* and *b*). When a low has become occluded, it usually decreases in intensity and rate of travel, and gradually fills up. On the other hand, a low which has a marked warm sector is likely to be deepening, the winds associated with it may increase in force and its rate of travel may increase. Lows are usually travelling in a direction approximately parallel to the isobars (and in the direction of the wind) in the warm sector.

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The approach of a low is indicated by a falling barometer. In the northern (southern) hemisphere, if the low is approaching from westward and passing northward (southward) of the ship, clouds appear on the western horizon, the wind shifts to a south-westerly (north-westerly) or southerly (northerly) direction and freshens, the cloud layer gradually lowers, and finally drizzle, rain or snow begins. If the low is not occluded, after a period of continuous rain or snow there is a veer (backing) of wind at the warm front, a rise of temperature and diminution or cessation of rain (or snow) in the warm sector, the visibility being usually moderate and the sky overcast with low cloud. The passage of the cold front is marked by the approach from westward of a thick bank of cloud (which however cannot often be seen because of the customary low overcast sky in the warm sector), a further veer (backing) of wind to west or north-west (south-west), sometimes with a sudden squall, rising pressure, a fall of temperature, squally showers of rain, hail or snow, and improved visibility (except during showers). The squally showery weather with a further veer (backing) of wind and drop in temperature may recur while the low recedes owing to the passage of another cold front or occlusion. If the low is occluded, the occlusion is preceded by the cloud of the warm front; there may be a period of continuous rain mainly in front of and at the line of occlusion, or a shorter period of heavy rain mainly behind the occlusion, according as the air in front of the occlusion is colder or warmer than that behind it. There may be a sudden veer (backing) of wind at the occlusion.

Often another low follows 12 to 24 hours later, in which event the barometer begins to fall again and the wind backs towards south-west (north-west), or even south (north).

If a low travelling eastward or north-eastward (south-eastward) is passing southward (northward) of the ship, the winds in front of it are easterly and they back (veer) through north-east (south-east) to north (south) or north-west (south-west); changes of direction are not likely to be so sudden as on the southern (northern) side of the low. In the rain area there is often a long period of continuous rain and unpleasant thick weather with low cloud. In winter in the colder regions the weather is cold and raw and precipitation is often in the form of snow.

Near the regions of lowest pressure, lulls are sometimes experienced, but sudden changes are likely, and in a deep low the wind may increase in strength very rapidly, perhaps to gale force as the barometer begins to rise.

Sometimes in the air circulation of a large low, usually on the equatorial side and often on a cold front, a secondary depression develops, travelling in the same direction as the primary but usually more rapidly. The secondary often deepens while the original low decreases in intensity. In the region between the primary and the secondary depressions, the winds are not as a rule strong; but on the further side of the secondary, usually the southern (northern) side, winds are likely to be strong and they may reach gale force. Thus the development of a secondary may cause gales at a greater distance from the primary than anticipated, while there may be only light winds where gales were expected.

The above is a brief general description of lows and the associated weather in temperate or middle latitudes of the northern (southern) hemisphere. It must be emphasised, however, that individual lows in different localities differ considerably from one another, according

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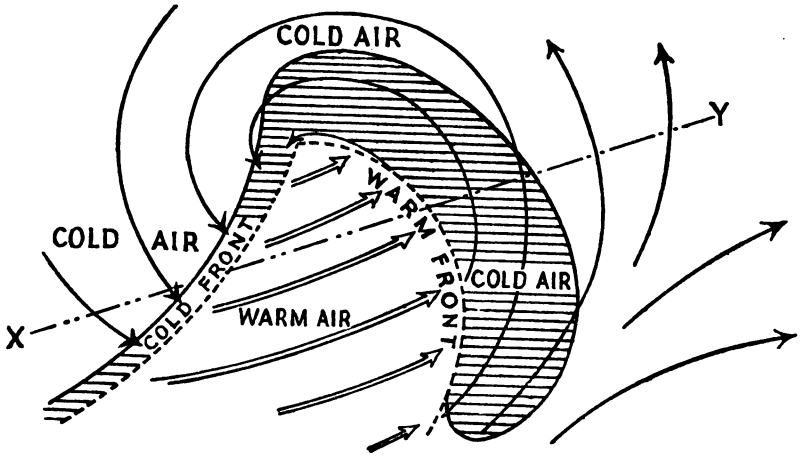
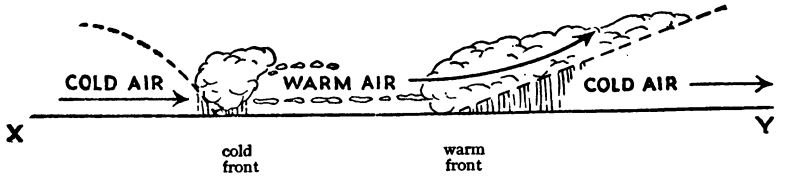
Fig. 1a.



Plan of a developed depression.

The double lines show the flow of the warm air, and the single lines the flow of the cold air.
The shading shows the areas where rain (or snow) is most probable.
Width of rain belt ahead of warm front is generally between 100 and 200 miles.

Fig. 1b.



Vertical section of the depression along the line XY.

[*See next page.*

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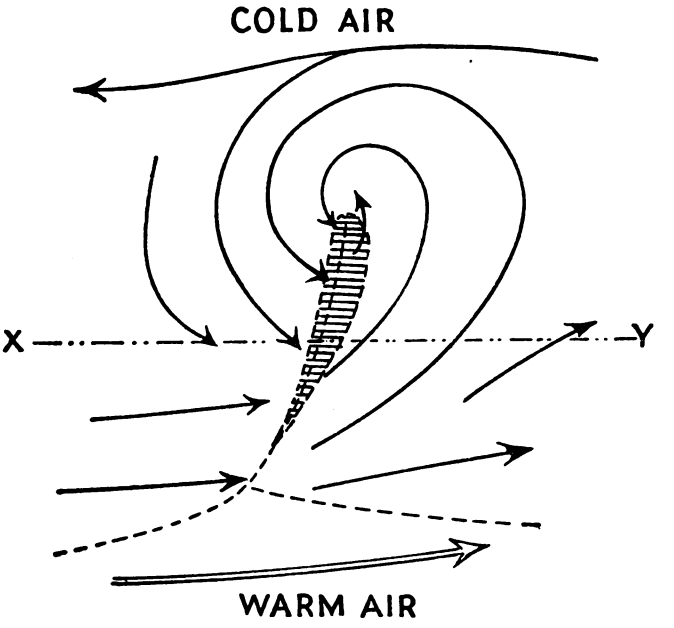
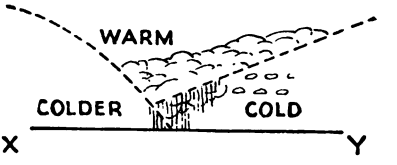
Fig. 2a.



Plan of an occluded depression.

The shading shows where rain (or snow) may be expected near the occlusion.

Fig. 2b.



Vertical section of an occlusion of the cold front type.

The air in front of the occlusion is warmer than the air behind it.

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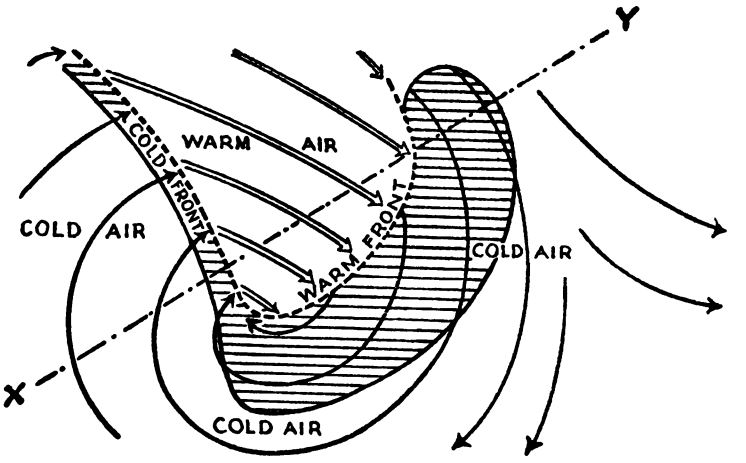
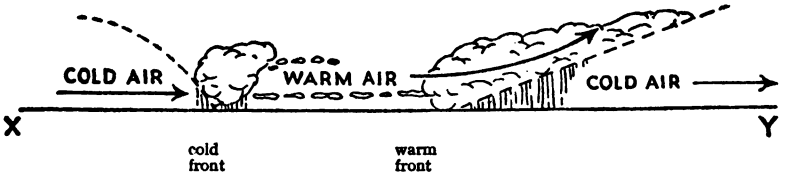
Fig. 1a.



Plan of a developed depression.

The double lines show the flow of the warm air, and the single lines the flow of the cold air
The shading shows the areas where rain (or snow) is most probable.
Width of rain belt ahead of warm front is generally between 100 and 200 miles.

Fig. 1b.



Vertical section of the depression along the line XY.

[*See next page.*

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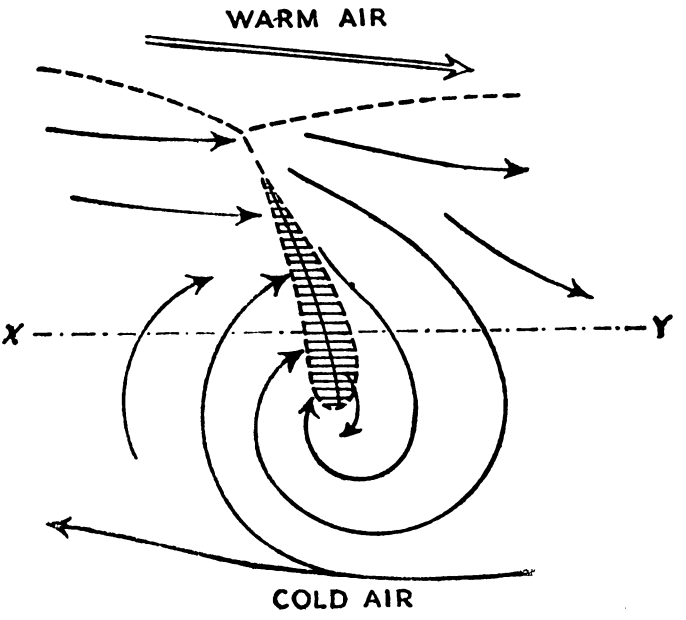
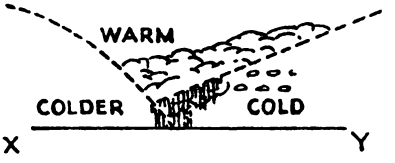
Fig. 2a.



Plan of an occluded depression.

The shading shows the region where rain (or snow) may be expected near the occlusion.

Fig. 2b.



Vertical section of an occlusion of the cold front type.

The air in front of the occlusion is warmer than the air behind it.

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to the characteristics (especially the temperature and humidity) of ace air currents of which they are composed, and the nature of the surfthe over which they are travelling.

(2) **Tropical revolving storms.**—*Practical rules for avoiding them.*—These storms are so named because the wind blows round an area in which the lowest pressure is at the centre. The direction of rotation is anti-clockwise in the northern hemisphere and clockwise in the southern hemisphere. The wind does not revolve round the centre of low pressure in concentric circles but has a spiral movement inwards, towards the centre of the storm field.

A tropical storm is not so extensive as the depression of higher latitudes but, within 75 miles or so of the centre, the wind is often far more violent, and the high and confused seas near the centre may cause considerable damage to large and well-found ships, while small vessels (for example, destroyers) have foundered. The danger is still greater when ships are caught in restricted waters without adequate room to manœuvre. Within 5 to 10 miles of the centre the wind is light or moderate and variable, the sky is clear or partially so, and there is a heavy, sometimes mountainous, confused swell; this area is known as the " eye " of the storm. After passing through the relatively windless centre of the storm the wind will suddenly, and with great violence, commence to blow from a direction almost opposite to that experienced on the other side of the windless centre. Due to torrential rain and sheets of almost continuous spray, visibility near the storm centre (but outside the " eye ") is almost nil.

Every ship navigating in an area subject to tropical storms during the season of their occurrence should be constantly on the alert for any sign of their approach, so that steps can be taken to avoid the danger zone while there is still time and sea-room.

Localities, season, and average frequency.—Tropical storms occur for the most part on the western side of the oceans, though they are also experienced in the Bay of Bengal, off the north-west coast of Australia, and off the west coast of Central America. They are unknown in the South Atlantic. They are given various names according to the part of the World in which they occur.

Western North Atlantic Eastern North Pacific South Pacific	–hurricanes
Western North Pacific	–typhoons
Indian Ocean Bay of Bengal Arabian Sea	–cyclones
North-west Australia	–willy-willies

They are most frequent during the late summer and early autumn of their hemisphere; they are comparatively rare in the southern hemisphere from mid-May to November, and in the northern hemisphere from mid-November to mid-June. In the Arabian Sea, however, storms are most likely to occur at the change of the monsoon, i.e., October-November, and May-June, though they average only one or two a year. Out-of-season storms occur from time to time, particularly in the western North Pacific where no month is entirely safe, and in the Indian Ocean where one is reported south of the Equator perhaps once in two years outside the usual season. The following table shows approximately the average number of severe tropical storms recorded

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per annum, from statistics taken over several years for the various areas:—

West Indies	5
Western North Pacific	25
,, South Pacific	3
Southern Indian Ocean	6
Bay of Bengal	2
Arabian Sea	1
Eastern North Pacific	3
West Coast of Australia	1

Variations in any one year amounting to 50% above or below the average are not unusual. Some of the figures quoted are probably an underestimate since in the less-frequented parts of the world many storms must escape detection.

Origin, movement and extent.—Tropical storms originate as a general rule in the doldrums, between the parallels of 7° and 15° of latitude; those which affect the western part of the Pacific, South Indian and North Atlantic Oceans are first reported in the western third of those oceans, though there are exceptions such as in the North Atlantic during August and September where an occasional storm is known to begin near the Cape Verde islands. In the northern hemisphere they move off in a direction between 275° and 350°, though most often within 30° of due west. When in a latitude of 25° or so they usually recurve away from the equator and, by the time they have reached the 30th parallel, the track (or path as it is more usually called) is north-easterly. In the southern hemisphere they move off in a WSW. to SSW. direction (usually the former), recurve at about 15° to 20° S., and thereafter adopt a south-easterly path. In either hemisphere many storms do not recurve but continue in a west-north-westerly (or west-south-westerly) direction until they reach the mainland where they quickly die.

The speed of advance of these storms is usually about 10 knots in their early stages, increasing a little with latitude; it seldom exceeds 15 knots before recurving, but after recurving 20 to 25 knots is usual though speeds of 40 knots or even more have been known.

Occasionally storms move erratically, the path turning towards the equator, or adopting an easterly component in a low latitude, or even making a complete loop, but on these occasions their speed of advance is low, usually less than 10 knots, while the unusual path is being followed.

The extent of the storm area varies considerably with individual storms but, generally speaking, winds of force 7 or more are improbable at more than 200 miles (especially on the equatorial side of the storm area) and force 8 is unlikely to be exceeded at more than 100 miles, from the storm centre, if in a latitude of less than 20°. Thereafter the radius increases with latitude so that these distances are nearly doubled on reaching the 35th parallel, but the intensity diminishes near the centre. Hurricane force winds are likely within 75 miles of the storm centre in the tropics, and gusts exceeding 150 knots have been reported in a few instances within 50 miles or so (except in the eye of the storm). The aim of the mariner should therefore be to remain as far as possible from the centre of the storm system.

Warning of existence or approach.—In most instances, warning of the position, intensity and probable movement of a storm is given by radio at frequent intervals by meteorological authorities ashore. (*See* Admiralty List of Radio Signals, Volume III.) Sometimes, however,

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there is insufficient evidence available for an accurate warning or even a general warning to be given and ships must then be guided by their own observations. Of the following indications of the proximity of a tropical storm, the first is by far the most reliable within 20° or so of the equator; it should be borne in mind, however, that very little warning may be expected of the approach of an intense storm of unusually small diameter.

(*a*) If the corrected barometer reading is 3 mb. or more below the mean for the time of year, as shown in a climatic atlas or on the appropriate chartlets in the meteorological text of this Pilot, suspicion should be aroused and action taken to meet any development, such as raising steam in any available additional boilers, &c. It should be noted, however, that the barometer reading must be corrected not only for height, latitude, temperature and index error (if mercurial), or for height and index error if aneroid, but also for diurnal variation, the amount of which is given for each hour of the day in the Air Ministry climatic atlases and in the meteorological text of this Pilot. If the reading thus corrected is 5 mb. or more below normal, it is time to take avoiding action for there can be little doubt that a tropical storm is in the vicinity. According to an analysis of observations in the Western Pacific the centre of the storm is then probably not more than 200 miles away. At this distance, at any rate in the China Sea vicinity, the wind has usually increased to about force 6.

When proceeding through an area liable to be visited by these storms it is desirable to take hourly readings of the barometer.

(*b*) An appreciable change in the direction and/or strength of the wind.

(*c*) A swell is sometimes evident, proceeding from a direction that approximates to the bearing of the centre. If ahead of the storm this indication may be apparent before the barometer begins to fall.

(*d*) Extensive cirrus cloud followed, as the storm becomes closer, by much alto-stratus cloud and subsequently fracto-cumulus or "scud."

(*e*) In addition there is the warning that can be given by Radar. The existence of moderate or heavy rain can usually, under favourable meteorological conditions, be detected at the extreme range of centrimetric radar, such as is normally used for navigational purposes afloat, depending on the vertical extent of the rainfall. Subrefraction might decrease and superrefraction increase this range as with any other target. Although moderate or heavy rain does not fall symmetrically all round a storm, it is continuous for at least 50 miles in a broad sector extending from the "eye" of the storm where there is a circular area of relatively light winds and clear or partially clear sky. By the time radar evidence of the exact position of the storm is available, the ship will probably be already in fairly high seas and experiencing winds of force 9 or 10. There should still be time, however, for her to avoid the centre of the storm.

Note.—In accordance with Article 35 of the International Convention for Safety of Life at sea it is the duty of every ship who suspects the presence or formation of a tropical revolving storm immediately to inform other vessels and shore authorities with all the means at her disposal. Weather reports should be made by radio at frequent intervals giving as much information as possible, especially corrected (*not* for diurnal variation as in (*a*) above) barometer readings. If barometer readings are uncorrected this fact should be stated in the signal.

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Information required by the seaman before deciding upon action to be taken.—To decide on the best course of action if a storm is suspected to be in the vicinity, the mariner requires to know:—

(*a*) the bearing of the centre of the storm;
(*b*) the semicircle in which the ship is situated;
(*c*) the path of the storm.

If an observer faces the wind, the centre of the storm will be from 9 to 11 points on his right-hand side in the northern hemisphere when the storm is about 200 miles away, i.e., when the barometer has fallen about 5 millibars and the wind has increased to force 6 or thereabouts; as a rule the nearer one is to the centre the more nearly does the angular displacement of the wind approach 8 points. A further check on the bearing of the centre may often be obtained by noting the direction from which the swell is coming. The swell travels approximately directly outward from the storm centre.

The semicircle in which the ship is situated can be determined by taking two such bearings with an interval of from two to three hours between observations, provided that allowance is made for the ship's movement. It can be assumed that the storm is not travelling towards the equator; and, if in a lower latitude than 20°, its path is most unlikely to have an easterly component; and, on the rare occasions when neither of these statements applies, the storm is moving very slowly. (Exceptions to this are most likely in the South Pacific, where occasional storms often move off on a course almost due south developing an easterly component at a latitude of about 15°, and in the western North Pacific where some of the out-of-season storms may recurve at an early stage.)

In a moving ship associated with a storm progressing at an unknown rate, it is very difficult to estimate from an apparent shift of wind the direction and speed of the storm's motion relative to the ship. The surest method of ascertaining the true shift of wind and thereby finding out in which semicircle the vessel is situated, *is to stop the ship during the period between the two bearings.* If in either hemisphere, these observations show that the wind is veering, the ship is in the right-hand semicircle; if the wind is backing she is in the left-hand semicircle; and if the wind remains steady in direction then the vessel is in the direct path of the storm, which is the most dangerous place of all.

The diagram headed " Typical Paths of Tropical Storms " (at the end of this article) illustrates the terms " dangerous semicircle " and " navigable semicircle." The former lies on the side of the path towards the usual direction of recurvature, i.e., the right-hand semicircle in the northern and the left-hand semicircle in the southern hemisphere. It is so called because a sailing or low-powered vessel caught in it may be blown towards the path along which the storm will pass, or the storm may recurve and the centre pass over her. The navigable semicircle is that which lies on the other side of the path. A ship situated within this semicircle will tend to be blown away from the storm centre, and the recurvature of the storm will increase her distance from the centre.

Practical rules for avoiding tropical storms.—In whatever situation a ship may find herself, the matter of vital importance is to avoid passing within 50 miles or so of the centre of the storm; it is preferable to keep outside a radius of 200 miles or more, because at this distance the wind does not often exceed force 7 (and is generally not more than force 6), and freedom of manœuvre is maintained. If a ship has at least 20 knots at her disposal, and shapes a course that will take her

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most rapidly away from the storm before the wind has increased above the point at which her movement becomes restricted, it is seldom that she will come to any harm.

Sometimes a tropical storm moves so slowly that a vessel, if ahead of it, can easily outpace it or, if astern of it, can overtake it. Since, however, she is unlikely to feel seriously the affects of a storm so long as the barometer does not fall more than 5 mb. (corrected for diurnal variation) below the normal, it is recommended that frequent readings should be made if the presence of a storm in the vicinity is suspected or known, and that the vessel should continue on her course until the barometer has fallen 5 mb., or the wind has increased to force 6 when the barometer has fallen at least 3 mb. If and when either of these events occurs, she should act as recommended in the following paragraphs, until the barometer has risen above the limit just given, and the wind has decreased below force 6. Should it be certain, however, that the vessel is behind the storm, or in the navigable semicircle, it will evidently be sufficient to alter course away from the centre.

In the northern hemisphere.—(*a*) If the wind is veering, the ship must be in the dangerous semicircle. A power-driven vessel should proceed with all available speed with the wind 1 to 4 points (depending upon her speed) on the starboard bow, and should subsequently haul round to starboard as the wind veers, thereby tracing a course relative to the storm as shown by the pecked line in the diagram. If a power vessel has insufficient room to make much headway when in the dangerous semicircle she should heave to in the most comfortable position relative to the wind, preferably with the wind on her starboard bow so that she is heading away from the centre of the storm.

(*b*) If the wind remains steady in direction, or if it backs, so that the ship seems to be nearly in the path (it is sometimes difficult to determine satisfactorily if indeed the ship is nearly in the path, particularly if in the dangerous semicircle, because the wind does not always behave according to rule) or in the navigable semicircle respectively, a power vessel should bring the wind well on the starboard quarter and proceed with all available speed, subsequently altering course to port as the wind backs, thus tracing a course relative to the storm as shown by the pecked line in the diagram.

In the southern hemisphere.—(*a*) If the wind is backing, the ship must be in the dangerous semicircle. A power-driven vessel should proceed with all available speed with the wind 1 to 4 points (depending upon her speed) on the port bow, and should subsequently haul round to port as the wind backs, thereby tracing a course relative to the storm, as shown by the pecked line in the diagram. If a power vessel has insufficient room to make such headway she should heave-to in the most comfortable position relative to the wind, preferably with the wind on her port bow so that she is heading away from the centre of the storm.

(*b*) If the wind remains steady in direction, or if it veers, so that the ship seems to be nearly in the path (it is sometimes difficult to determine satisfactorily if indeed the ship is nearly in the path, particularly if in the dangerous semicircle, because the wind does not always behave according to rule) or in the navigable semicircle respectively, a power vessel should bring the wind well on the port quarter and proceed with all available speed, subsequently altering course to starboard as the wind veers, thus tracing a course relative to the storm as shown by the pecked line in the diagram.

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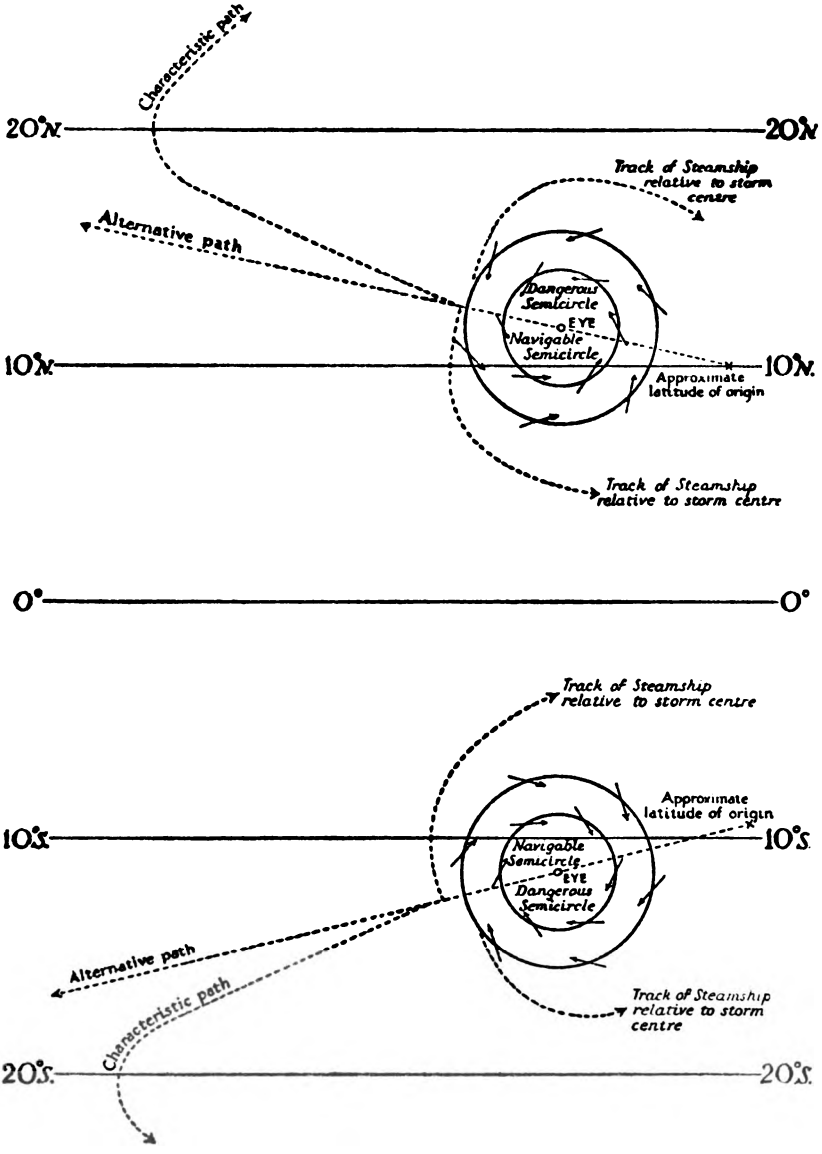
TYPICAL PATHS OF TROPICAL STORMS



Note.—In this diagram the isobars are shown as concentric circles about the eye; in practice this is usually the case within 150 miles or so of the centre. Outside this distance the isobaric form often loses its symmetry and strong winds often extend farther on the polar side than on the equatorial.

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If there is insufficient room to run when in the navigable semicircle, and it is not practicable to seek a safe and effective shelter before the storm begins to be felt, a vessel should heave-to in the most comfortable position relative to the wind and sea, bearing in mind the proximity of land.

If a ship finds that she is in the direct path of the storm and has no room to run into the navigable semicircle as directed above, it should be considered, bearing in mind possible recurvature, whether she should endeavour to make her way into the "dangerous" semicircle (where she may at least be better off than remaining in the direct path of the storm) and continue to steam to windward as fast as she can so as to get as far as possible from the centre.

If in harbour, or at anchor, a seaman should be just as careful as at sea in watching the shifting of the wind and estimating the movement of the storm relative to himself, so that he may consider shifting his berth with advantage or otherwise act according to circumstances. It is usually preferable, however, to put to sea if this can be done in sufficient time to avoid the worst of the storm. Riding out a tropical storm, the centre of which passes within 50 miles or so, in a harbour or anchorage, even if some shelter is offered, is an extremely unpleasant and hazardous experience, especially if there are other ships in company. Even if berthed alongside, or with special moorings and long bridles in use, a ship cannot feel entirely secure.

Discretion must, of course, be used. In the case of a low-powered or small vessel with, for example, insufficient warning to enable her to gain sufficient distance from the storm by putting out to sea, it will be preferable to remain in a reasonably sheltered harbour. If at sea and warning of an approaching storm is given and there is considered to be insufficient time or sea-room to avoid the dangerous part of the storm area, it may be advisable for vessels of this type to seek shelter. In the China Sea, for example, there are so-called typhoon harbours which are listed in the Admiralty Pilot. In all cases, however, the mariner must use seamanship and initiative.

(3) Local modification of the weather near the coast.—The meteorological information given in Chapter I takes little or no account of local peculiarities of wind and weather due to coastal topography. These local effects are often unpredictable, especially where the coast has many deep indentations. Nevertheless, the general character of local topographical effects, in the vicinity of a given position, may sometimes be predicted with the help of the following notes.

(i) If the coast is bordered by steep cliffs, or if there are high hills or mountains in the hinterland, approximately parallel with the shore, onshore winds which are only slightly inclined to the coastline are usually deflected so as to blow nearly parallel with the coast, and they increase somewhat in speed. This effect is particularly noticeable in a long strait not more than a few miles wide, and where the strait narrows there is often a big increase of speed.

(ii) When the wind is onshore and nearly perpendicular to the coast, and there are high cliffs, there is usually a narrow belt of contrary gusty winds close to the coast.

(iii) An offshore wind is often squally on the lee side of a hilly coast, especially where the wind is much cooler than the sea surface.

(iv) Land and sea breezes are generally prominent in settled fine weather, especially in latitudes lower than 40° S. or N.

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The sea breeze blows from the sea to the land during the daytime, and is generally strongest in the afternoon; it occasionally reaches force 5, and sometimes extends 20 miles or more seaward.

The land breeze blows from the land to the sea. It does not usually begin until a few hours after sunset, but may continue for an hour or two after sunrise. It seldom exceeds force 4, and does not usually extend more than 5 miles seaward.

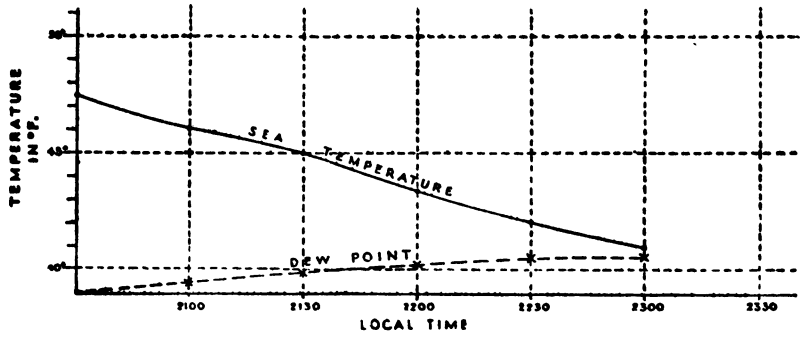
(v) When sea fog is general over the open sea, there is nearly always better visibility close to leeward either of a hilly island or promontory, or of any land strongly heated by the sun.

(vi) Radiation fog, which may form over land on quiet nights with clear skies, sometimes spreads 10 miles or more seaward. In temperate latitudes it is usually most frequent in autumn and winter.

(4) **Forecasting sea fog.**—The most frequent type of fog in the open sea is that caused by relatively warm air flowing over a colder sea. Warning of this type of fog may be obtained by frequent observations of air and sea surface temperatures; if the sea temperature falls below the dewpoint of the air, fog is almost a certainty. The following procedure is recommended whenever the temperature of the air is higher than, or about equal to, that of the sea, especially at night when approaching fog cannot be seen until shortly before entering it.

Sea and air (both dry and wet bulb) temperatures should be observed at intervals of about 5 miles and the sea temperature plotted against dewpoint. The dewpoint is obtainable from tables published in various text-books, but at temperatures up to about 60° F. a close enough approximation may be obtained by assuming it to be the same amount below the wet-bulb temperature as the latter is below the dry-bulb temperature; for example, if the dry bulb reads 50° F. and the wet bulb 48°, the dewpoint is about 46°. If the curves of sea temperature and dewpoint converge, fog may be expected by the time at which they coincide.

The figure below represents conditions that might be found by a low-powered ship in about long. 40° W. proceeding westward on the appropriate lane route for Halifax, Nova Scotia. At 2200 it would become evident that there is a probability of running into fog in about an hour's time, assuming that the sea temperature continues to fall at about the same rate that it has done during the last 1½ hours.



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From the appropriate chart of average sea surface temperatures it can be seen where a rapid fall of temperature may be expected, so that if the dewpoint is within 5° or so of the sea temperature when approaching the colder water zone, this will also give a fairly reliable warning of fog.

If it is desirable and practicable to escape from fog, a ship should steer for warmer water which will again be evident from the charted isotherms.

Fog, or very poor visibility, at sea may also occur in snow or heavy rain, or in association with the passage of a warm front or occlusion, or, when within 20 miles or so of land, it may occur as a result of radiation fog extending from the land; in high latitudes in winter, frost smoke may be met near land, when very cold offshore winds are blowing, or near extensive ice. The method described above will not give warning of these fogs, of which frontal fogs, though common in middle latitudes, are neither so extensive nor so persistent in any one locality, and the other fogs mentioned are rarely encountered far from land (or extensive ice).

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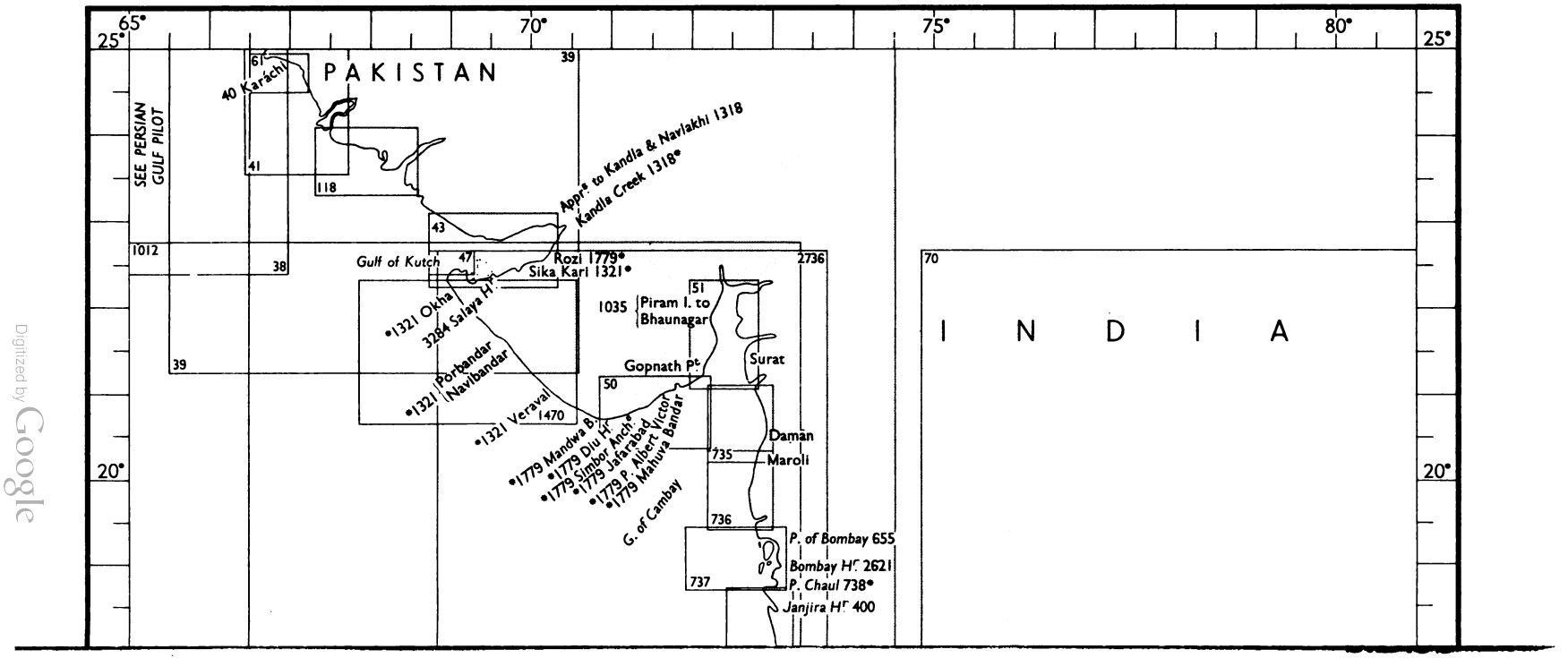

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WEST COAST OF INDIA PILOT

CHAPTER I

MALDIVE AND LACCADIVE ISLANDS.—CEYLON.—REPUBLIC OF INDIA.—REPUBLIC OF PAKISTAN.—PORTUGUESE POSSESSIONS.—CURRENTS.—TIDAL STREAMS.—SOUNDINGS.—LUMINOSITY OF THE SEA.—STORM SIGNALS.—SIGNALS.—SIGNAL STATIONS.—RADIO STATIONS.—BUOYAGE SYSTEMS.—AIR LIGHTS.—SUBMARINE CABLES.—FISHING VESSELS.—LIFE-SAVING.—STANDARD AND SUMMER TIMES.—FUEL.—REPAIRS.—QUARANTINE.—CLIMATE AND WEATHER.—CLIMATIC TABLES

Chart 748b.

MALDIVE ISLANDS.—Maldive islands, the southern atoll of which lies about 600 miles south-south-westward of Cape Comorin, the southern extremity of the Indian sub-continent, extend in a northerly direction for about 470 miles.

Chart 2898.

They consist of nineteen groups of islets, known as atolls, for the most part surrounded by barrier reefs.

The islets are in general not more than 5 or 6 feet (1^{m}5 or 1^{m}8) high, so that the coconut trees on them appear on first approach to be growing out of the water. There is no bottom at a depth of 200 fathoms (365^{m}7) close to the sea face of the islets and reefs.

The capital is Male (*Lat. 4° 10′ N., Long. 73° 30′ E.*), which is situated on Male or Sultan's island, one of the islands of Male atoll. The Sultan of Maldive islands resides at Male.

Population.—Language.—The Maldivians are all Moslems and of mixed stock. They are great navigators and traders, and in 1956 numbered about 81,950.

A very large portion of the Maldivian vocabulary consists of pure Sinhalese words with modified vowels and change of " p " to " f " due to Arabic influence, or of derivatives from a root common to the two languages. Intercourse with other races has added a considerable number of words of foreign origin.

Occupations.—Fishing, including turtle catching, is the main industry of the islands; others are basket making, cloth weaving, jewellery manufacture and lacquer work. Coir and lace making are the principal occupation of the womenfolk. There is also considerable cultivation.

Government.—Maldive islands have been under British protection since 1887 and enjoy complete independence in their internal affairs.

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Chart 2898.

A new agreement, signed in February 1960, left only defence and foreign relations a British responsibility.

The islands are governed by the Sultan, a Prime Minister and Heads of Departments chosen by the Sultan in consultation with the People's Assembly, to which body they are responsible. The People's Assembly consists of 33 members, of whom 27 are elected by the islanders and 6 nominated by the Sultan. The seat of government is at Male (*Lat. 4° 10′ N., Long. 73° 30′ E.*).

In 1960, the Maldivian Government gave the island of Gan in Addu atoll to the British Government for 30 years.

Products.—The coconut palm is most extensively planted. Almond and areca trees, lime trees, plantains, papaws, pineapples, pomegranates, pumpkins, sugar-cane, sweet potatoes and some other bulbous roots are grown. Millet is grown to a small extent, but all the rice, which is the chief article of vegetable food, is imported. Cotton is grown in small quantities on some of the islets. Cowri shells are found in large quantities. On the southern atolls there is least cultivation, although the rainfall is the greatest.

Coral fish abound. The sword fish is common, and sometimes found 18 feet (5^{m}5) in length. Turtles, sharks and porpoises are plentiful, and from them oil is obtained. The bonito fishery is the chief employment of the islanders, that fish being the principal article of food as well as of commerce.

Trade.—The whole of the export and import trade of the islands, carried on by foreigners, is conducted at Male, whither the produce of all the other atolls is brought. The external trade of Male consists of two branches, one carried on by traders from Ceylon and the Malabar coast resident on the island, the other by the islanders themselves in their own vessels.

Exports.—The foreign traders barter principally for bonito (kalu-bilamas), of which a large quantity is shipped off every season to Ceylon, where the demand is greatest, Penang and Singapore. Tortoise-shell, copra, coir yarn, cowries and a few mats compose the other articles of export.

That portion of the external trade which is conducted by the natives is carried on chiefly with Calcutta and Ceylon in boats of 100 to 200 tons burden.

Imports.—The imports are rice, dates, salt, tobacco, areca nuts, cloth, cotton, curry-stuff, ghi, china-ware, Indian pottery, kerosene oil, sugar, etc.

Quarantine.—A vessel with smallpox on board is put under the strictest quarantine for 40 days after the recovery of the person last affected. In cases where the disease was prevalent at the place from which the vessel came, though there be no sickness on board, quarantine is nevertheless enforced, but the period is limited to 12 days.

Currency.—The rupee is current in the islets, and is used in all money transactions. A copper coinage is in use; these coins are termed bodu (large) lari and kuda (small) lari, and have a nominal exchange value, respectively, of 30 and 120 to the rupee. Cowries are no longer in use. Ceylon coins are negotiable. Paper money is not acceptable.

Climate.—The unhealthiness of the climate of the Maldives has long been notorious; this may be partly due to the lagoons and marshes which abound and partly to the unvarying temperature of the atmosphere.

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Chart 827.

LACCADIVE ISLANDS.—*See* page 10.

Chart 828.

CEYLON.—Ceylon, the ancient Taprobane, is an important island off the south-eastern part of the Indian sub-continent to which it is almost connected by a narrow line of islands and shoals, which form the head of the Gulf of Mannar.

The capital and seat of government is Colombo (*Lat. 6° 56′ N., Long. 79° 50′ E.*).

History.—According to the Mahawamsa chronicle, an Indian prince from the valley of Ganga (Ganges) river, named Vijay, arrived in the 6th century B.C. and became the first king of the Sinhalese. A monarchial form of government continued until the beginning of the 19th century when the British subjugated the Kandyan kingdom in the central highlands.

In 1505, the Portuguese formed settlements on the west and south coasts of the island, but these were taken from them about the middle of the next century by the Dutch. In 1796, the British Government annexed the foreign settlements on the island to the presidency of Madras, and, in 1802, Ceylon was separated from India and became a Crown colony.

After passing through various stages of increasing self-government Ceylon attained full membership of the British Commonwealth of Nations on February 4th, 1948.

Physical features.—The central part of the southern half of the island is mountainous, and, on a clear day, its outline is visible from the western seaboard. Pidurutalagala, the summit of the island, 8,296 feet (2,528^{m}6) high, cannot be identified from seaward. The remarkable cone known as Adam's peak, 7,353 feet (2,241^{m}2) high, is very prominent from westward and southward during the north-east monsoon.

On the western side of the mountain district the foot-hills lie compactly together in long parallel folds, but elsewhere on its western side the island is practically flat.

The west and south coasts are planted more or less densely with coconut trees; these trees are also found in the vicinity of every village in the island, at which the temperature is suitable to their growth.

One of the peculiarities of the coastal parts is the extensive fresh and salt water lagoons, lying but a short distance inland. These lagoons are found on the west coast, but only to a limited extent at the southern end. They appear to have been formed by the action of the sea currents off the coast, combined with that of the monsoon swell, in piling up a sand ridge, thus enclosing a space, originally of sea water. These lagoons may now be seen in process of formation in the northern parts, but in the southern parts they are complete, and lie some distance inland, the water in them having become fresh from the heavy rainfall usual in Ceylon.

Slight earthquake shocks are occasionally felt in Ceylon, but they are not sufficiently intense to cause serious damage.

Rivers.—The island, in the parts adjacent to the mountains, is well watered, but in the flat country less permanently so. The rivers on the western side, fed by the longer-continuing rains of the south-west monsoon, are never without water, but those flowing northward, dependent on the shorter rainy season of the north-east monsoon, are

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Chart 828.

reduced at other times of the year to dry sandy river beds, with a few pools.

The principal rivers reaching the sea on the west coast, northward of Colombo, range in length between about 80 and 100 miles; they are Kelani ganga, the mouth of which is about one mile northward of Colombo (*Lat. 6° 56′ N., Long. 79° 50′ E.*); Maha oya, the mouth of which is about 17 miles northward of the mouth of Kelani ganga; Deduru oya, the mouth of which is about 20 miles northward of the mouth of Maha oya; Kala oya, the mouth of which is about 42 miles northward of the mouth of Deduru oya; and Aruvi aru, which flows into the sea about 32 miles northward of the mouth of Kala oya. These rivers all have bars at their mouths, and are only navigable by native boats for about 30 to 40 miles.

Population.—The population of Ceylon comprises various races, notably the Sinhalese, Tamils, Moors, Eurasians and Malays.

In 1953, the population of Ceylon was 8,097,861 of whom about 6,500 were Europeans.

The majority of the inhabitants are Buddhists, and the official language is Sinhalese.

Government.—The Parliament of Ceylon consists of the Queen, represented by the Governor-General, the Senate and the House of Representatives. A Prime Minister and Cabinet are responsible to Parliament for the general direction and control of Government.

The House of Representatives is composed of 151 elected and 6 nominated members; the Senate consists of 30 members, of which 15 are elected by the House of Representatives and 15 nominated by the Governor-General.

The island, which has an area of 25,332 square miles, is divided for administrative purposes into 12 regions, each of which has an Assistant Commissioner for Local Government.

Trade.—Shipping.—The principal exports are coconuts, tea, rubber, coconut oil, copra and cinnamon. The chief imports are rice and paddy, cotton manufactures, sugar, manures, coal and coke.

In 1958, about 4,700 vessels, with an aggregate tonnage of about 11,700,000 tons, entered and cleared the ports of Ceylon.

Weights and measures.—The standard weights and measures used in Ceylon are the same as those of Great Britain. In conjunction with these many local weights and measures are used.

Currency.—The monetary unit is the Ceylon rupee of 100 cents, which has a par value equal to 2.88 grains of fine gold. It is equivalent to about 1s. 6d. sterling.

Currency notes to the value of one rupee, 2, 5, 10, 50 and 100 rupees are in circulation. Coins with values of one cent, 2, 5, 10, 25 and 50 cents are legal tender.

Communications.—There is regular communication by sea and air between Colombo and various parts of the world. There are also internal air services.

The Ceylon railway is owned and operated by the Government. The principal towns on the coast are connected with the railway system, and most of the towns and larger villages are connected with the telegraph and telephone systems.

Port.—The only port in Ceylon covered by this volume is the artificial harbour of Colombo, which is available to all classes of vessels.

Climate.—The heat in the low country of Ceylon is less oppressive than in India. There is often a refreshing breeze, particularly near the

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Chart 828.

coast. The climate of Colombo is so largely tempered by sea breezes that it is one of the healthiest places in the tropics in which to reside. Parts of Ceylon are malarious, but the south-western part of the island is comparatively free from this disease. *See* Climatic table for Colombo on page 45.

Charts 827, 826.

REPUBLIC OF INDIA.—By the Indian Independence Act, 1947, India became a self-governing and independent member of the British Commonwealth of Nations on July 18th, 1947. On January 26th, 1950, India was proclaimed a republic whilst still continuing full membership of the Commonwealth.

The Republic consists of 15 States and 6 Union Territories, of which the States of Madras, Kerala, Mysore, Maharashtra and Gujarat and the Union Territory of Laccadive, Minicoy and Amindivi islands lie within the area covered by this volume; they are described below.

The capital and seat of Government is New Delhi.

The official language is Hindi, but English continues to be used.

Government.—The government of the country is divided between Parliament and the individual states; the former controls matters of all-India importance, such as foreign affairs, etc., and administers Union Territories, whilst the latter legislate on local matters within their own boundaries.

Parliament consists of the President and two houses, namely the Council of States (Rajya Sabha) and the House of the People (Lok Sabha).

Currency.—The monetary unit is the Indian rupee sub-divided into 100 naye paise. It is equivalent to about 1s. 6d. sterling.

Currency notes of the values of one rupee, 2, 5, 10, 100, 1,000, 5,000 and 10,000 rupees are in circulation. Coins with values of one rupee, one, 2, 5, 10, 25 and 50 naye paise are legal tender.

Weights and measures.—The metric system of weights and measures has generally been adopted and will be the only one recognised after December, 1966. The following measurement of weight may however be encountered until that date:—

The standard maund of 40 seers = 82 lb. 4 oz. 9 dr. avoirdupois.

The standard tola=180 gr. troy.

The standard seer of 80 tolas=2·057 lb.

The standard pound (7,000 standard grains), ounce, cwt. and ton are also standard weights side by side with the above.

Charts 827, 828.

Madras.—The State of Madras lies at the southern end of the eastern side of the Indian peninsula. It is bounded westward by the State of Kerala and northward by the States of Mysore and Andhra Pradesh. The city of Madras is the state capital.

The districts of Ramanathapuram, Tirunelveli and Kanyakumari only are covered by this volume; they lie adjacent to each other at the southern end of the State and their seaboards form the north-western shore of the Gulf of Mannar and the west coast of the Indian peninsula to a position about 25 miles west-north-westward of Cape Comorin, its southern extremity.

The vast majority of the population are Hindus. Tamil is the language of the State.

Agriculture and the production of cotton are the main industries of the State.

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Charts 827, 828.

Physical features.—The districts of Ramanathapuram and Tirunelveli lie on a flat plain, with an average elevation of about 200 feet (61^{m}0), which gradually rises, westward of Manappad point (*Lat. 8° 22′ N., Long. 78° 04′ E.*), to the foothills of the Southern Ghâts; these mountains attain an elevation of more than 6,000 feet (1,828^{m}8) and form the western boundary of Tirunelveli district.

The coasts of these districts are low, level and fringed with coconut palms. Eastward of Tuticorin there are a few villages on the coast, but southward and south-eastward of the Southern Ghâts it is lined with numerous fishing villages with small white churches, none of which, however, provide prominent marks.

The small district of Kanyakumari lies between the Southern Ghâts and the coast south-westward. Mahendragiri, 5,427 feet (1,654^{m}1) high, is the highest peak of the Southern Ghâts in Kanyakumari district.

The coast is sandy, fringed with coconut palms and has many villages with small white churches on it.

Port.—The only port of any importance in the area covered by this volume is Tuticorin.

Charts 827, 826.

Malabar coast.—The coast between Cape Comorin and about the latitude of Goa is known to mariners as the Malabar coast, though this name is also loosely applied to the whole seaboard as far northward as Bombay.

Chart 827.

Kerala.—The State of Kerala lies on the Malabar coast between latitudes 8° 15′ N. and 12° 45′ N. approximately. It is bounded southward by the State of Madras and northward by Mysore. Trivandrum (*Lat. 8° 30′ N., Long. 76° 56′ E.*) is the state capital.

The districts of Trivandrum, Quilon, Alleppey, Ernakulam, Trichur, Pālghāt, Kozhikode and Cannanore front the coast from south to north.

The majority of the population are of the Malayalam speaking race. Malayalam, Tamil and Kannada are the main languages spoken in the State.

The northern part of Kerala is rich in rubber and tea plantations and copper, whilst large quantities of rice are grown in Ernakulam and Trichur districts.

Physical features.—The Western Ghâts, which extend along the whole length of the west coast of the Indian peninsula, at distances varying from 10 to 100 miles inland, form the eastern boundary of the State; their elevations range from 3,000 to over 8,000 feet (914^{m}4 to 2,438^{m}4), and they run almost parallel with the coast.

On the Coorg slopes abreast Mount Delly they vary between 3,000 and 5,000 feet (914^{m}4 and 1,524^{m}0), rising to over 7,000 feet (2,133^{m}6) on the Kunda face abreast Calicut.

Anaimudi, 8,840 feet (2,694^{m}4) high and the highest peak southward of the Himalayas, lies about 50 miles east-north-eastward of Cochin, whilst Agastya Malai (Cuchy Mulla), 6,125 feet (1,866^{m}1) high, is situated at the southern end of the State about 20 miles north-eastward of Trivandrum.

One of the most striking features of the Western Ghâts, in this area is Pālghāt gap, eastward of Ponnâni; this break in the mountain range is some 16 miles wide and faced in the southern side by the remarkable Kollengode (Kollangod) bluff, which rises to an elevation of 5,000 feet (1,524^{m}0) and forms the northern face of Anaimalai mountains.

Southward of Pālghāt gap, the hill region is very extensive. Some of

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Chart 827.

the loftier mountains are entirely detached, except near their bases, and often have a precipitous descent on their western side. On this side they are connected with a succession of lower eminences that diminish in altitude as they approach the coast.

In contrast, the coastal belt of flat country, extending some 10 miles inland, is covered with an almost unbroken mass of coconut and areca palms, whilst along the coast, standing high, are white sand dunes and areas of red sand or *teri*, which form good landmarks.

The whole surface of this coastal belt is undulating and presents a series of hills and valleys, traversed from east to west by many tortuous rivers, which, near the coast, flow into numerous lagoons and backwaters. Artificial canals, in places, connect these backwaters and lagoons, and form an inland line of smooth-water communication extending for about 80 miles between Alleppey and Ponnáni (*Lat.* 10° *48′ N., Long. 75° 54′ E.*).

This great backwater is a striking feature of the southern part of the coast of Kerala. It varies in width from about 8 miles to a few hundred yards and is fed by several rivers, which rise in the Western Ghâts. The drainage of the extensive area, through which these rivers flow, increases greatly during the south-west monsoon and is the probable cause of the constantly shifting soft mudbank, described on page 147, which is a peculiarity of this coast.

Northward of Pālghāt gap, the Western Ghâts look down on a country broken by long spurs, extensive ravines and dense forests. Stretching westward, gentler slopes and gradually widening valleys, succeed the forest-clad uplands, until, near the seaboard, the low laterite tablelands shelve into rice plains and backwaters fringed with coconut palms.

Numerous rivers flow to the coast, where they discharge into the all but continuous line of backwaters, of varying breadth, parallel to the coastline. The coast forms a few headlands, and contains the summit of a conspicuous promontory known as Mount Delly.

Ports.—Cochin, the principal port, is one of the largest on the west coast of India and one of the few on the Malabar coast which is open all the year round. Other ports are Quilon, Alleppey, Calicut, Tellicherry and Cannanore.

Mysore.—The western seaboard of the State of Mysore extends northward from the northern boundary of Kerala to the Portuguese territory of Goa. Bangalore is the state capital.

The districts of South and North Kanara front the coast.

The majority of the population are of the Kannada speaking race, and about 70% depend on agriculture for their livelihood.

The State is rich in hydro-electric power and fairly rich in minerals, being the only gold-producing State in the Republic.

Physical features.—The Western Ghâts continue parallel with the coast through the State, but, except in the southern part where they attain elevations of over 6,000 feet (1,828^{m}8), they are much lower varying between 2,500 and 3,000 feet (762^{m}0 and 914^{m}4) in elevation.

The country in South Kanara district is very broken and covered with extensive forest and abundant vegetation. The seaboard for from 5 to 25 miles inland may be roughly described as a tableland, 200 to 400 feet (61^{m}0 to 121^{m}9) high, rising to 600 feet (182^{m}9) towards the Ghâts, bounded by the lower spurs sloping down from the range.

In North Kanara, the lowlands of Payanghat, a belt of from 5 to 15 miles wide, lie between the coast and the foothills of the Western Ghâts.

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Chart 827.

The coastline is only broken by Kārwār headland in the north, and by the estuaries of the rivers and the mouths of smaller streams, which flow into numerous lagoons that wind several miles into the interior. The coast is generally sandy, and fringing its margin behind the lagoons rise groves of coconut trees, inland of which stretches a narrow strip of level rice land. From this belt rise a few smooth flat-backed hills, from 200 to 300 feet (61^{m}0 to 91^{m}4) high; at places it is covered by lofty rugged densely-wooded spurs, which maintain almost to the coast an elevation of above 1,000 feet (304^{m}8).

The forests of North Kanara, chiefly of teak, with smooth stems, 70 feet (21^{m}3) in height, form its principal feature. Wild animals are numerous.

Ports.—Mangalore (*Lat. 12° 51′ N., Long. 74° 49′ E.*) and Kārwār are the only two ports of any importance.

Chart 826.

Konkan coast.—Northward of North Kanara, as far as the northern boundary of the district of Thāna (*see* below), the seaboard is known as the Konkan coast, although that southward of Bombay is often referred to as part of the Malabar coast.

Maharashtra.—The State of Maharashtra in the third largest in the Republic; its western seaboard extends along the Konkan coast between the Portuguese territories of Goa, in the south, and Damān, in the north. The state capital is Bombay.

The districts of Ratnágiri, Kolāba and Thāna front the Konkan coast from south to north.

Agriculture is the main industry, Maharashtra being one of the major sugar-producing states of the Republic. It is also rich in iron and manganese ores, and there are considerable industries particularly in the area of Bombay.

Physical features.—The Western Ghāts, with general elevations of from 2,000 to 3,000 feet (609^{m}6 to 914^{m}4) but with some peaks nearly 5,000 feet (1,524^{m}0) high, run almost parallel with the coast leaving a strip of land up to 60 miles wide, known as Konkan, between them and the sea.

Ratnágiri district, lying between Goa and Savitri river, is generally rocky and rugged; near the coast it consists of bare elevated plateaux, intersected by numerous creeks and navigable rivers, flowing between steep and lofty hills. About 10 miles inland the country becomes more open, but a little farther back it is occupied by spurs of the Western Ghāts. The coast is almost uniformly rocky, and consists of small bays and coves shut in between jutting headlands, and edged with sand of dazzling whiteness.

Kolāba district, lying between Savitri river and Bombay harbour, is very hilly, some of the hills being spurs of considerable regularity and height, running westward at right angles to the main range, while others are isolated peaks or lofty detached ridges. A series of minor ranges runs in a northerly and southerly direction between the main range and the coast. The sea frontage is mostly fringed by a belt of coconut and areca-nut palms, behind which lies a stretch of flat rice-producing country.

The coastal region of Thāna district, lying between Bombay harbour and Damān, consists of a strip of low land intersected by hill tracks of from 100 to 2,500 feet (30^{m}5 to 762^{m}0) high; the flat alluvial belt between Ulas and Vaitarna (Waitarna) rivers is known as North Konkan. Eastward and north-eastward the country becomes elevated

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Chart 826.

and wooded, while, near the coast, the land is low and fertile with abundant palm growth and populous villages.

Ports.—Bombay is the principal seaport on the west coast of India. There is a string of small ports along the coast such as Vengurla, Malvan, Vijaydurg, Ratnágiri, Port Dabhol and Port Chaul; these are served by the Konkan ferry service.

Gujarat.—The coastline of the State of Gujarat extends from the northern boundary of Damān (*Lat. 20° 24′ N., Long. 72° 49′ E.*) to the eastern boundary of West Pakistan and includes Kāthiāwār peninsula. The provisional state capital is Ahmedabad.

The districts of Surat and Broach front the eastern side of the Gulf of Cambay, those of Bhavnagar, Amreli, Junagda and Jāmnagar are situated on Kāthiāwār peninsula and the district of Kutch forms the northern side of the Gulf of Kutch. The coastal regions of Junagda and Jāmnagar districts are known as the Saurashtra coast.

Gujarati is the common language of the State.

Gujarat is rich in minerals such as salt, limestone and manganese, and oil has been found in the Cambay area. The major industries of the State are textiles, general and electrical engineering and cement.

Physical features.—Surat district consists of a broad alluvial plain, with small hillocks of drifted sand fringing the greater part of the coast, which in some parts is dry and barren, and in others watered by springs. Through the openings of the river mouths the tide flows up behind the barrier of sand-hills, and floods a large area of salt marshes. Beyond spreads a belt of highly cultivated land, restricted by the hills towards the south to a breadth of little more than 15 miles, but with a width of about 60 miles in the north, where Tapti river forms a deep and fertile delta.

Broach district forms an alluvial plain, sloping gently westward, varying in breadth from 20 to 40 miles; with the exception of a few hillocks of sand-drift along the coast, there is no rising ground. The soil is highly fertile and well cultivated.

Kāthiāwār peninsula, except in its northern part, which is almost entirely flat, is generally undulating with low ranges of hills running in irregular directions. There are extensive mountain tracts lying within about 35 miles of its south-western seaboard; Gir hills, situated roughly northward of Diu head, and Barda range, approximately north-eastward of Porbandar, are the principal mountain groups. The highest summit, however, that of Gorakhnāth (Girnar) with an elevation of 3,662 feet (1,116^{m}2), lies about midway between them.

Kutch district is practically an island, being almost entirely cut off from the mainland by Khori (Kori) branch of Indus river, the Rann of Kutch and the Little Rann. On the whole the country is treeless, barren and rocky with ranges of hills and isolated peaks, but it contains many well-tilled valleys and tracts of rich pasture land. To the southward, behind a high bank of sand that lines the sea coast, there is a low, fertile plain from 20 to 30 miles wide; inland of this a broad belt of hilly ground, from 500 to over 1,000 feet (152^{m}4 to 304^{m}8) high, stretches in an easterly and westerly direction; Nanu or Nunnomar, Krikubbah, and Kātrura are the principal summits.

The most striking physical feature of the State of Gujarat is the Ranns or salt marshes in the north-western part of the State. The Rann of Kutch (Great Western Rann) lying northward of the district of that name, is about 160 miles long and 80 miles broad, with an estimated area of about 7,000 square miles. The Little Rann, at the head of the

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Chart 826.

Gulf of Kutch, is about 70 miles in length, and covers an area of nearly 2,000 square miles. In appearance and general character these Ranns differ but little; the dark soil is generally caked by the action of the sun on the saline particles with which it is impregnated. At times the whole surface, particularly of the eastern part of the Ranns, is covered with salt, which shows with dazzling whiteness during the summer heat, accompanied by much mirage. With the exception of some of the smaller islands, where grass and a few stunted bushes may be found, there is no sign of vegetable life, but wild asses and antelope roam over the place and find subsistence. During the south-west monsoon high tides cover the Ranns to a depth of from one to 2 feet (0^m3 to 0^m6). The Little Rann is undergoing marked change; the sea is encroaching farther eastward, making places accessible to boats which were formerly dry.

Kala Dongar, the highest point in Kutch, about 1,525 feet (464^m8) high, stands out from the bed of the Rann of Kutch.

Ports.—The principal port in the State is the rapidly expanding port of Kandla (*Lat. 22° 59′ N., Long. 70° 13′ E.*) at the head of the Gulf of Kutch. Other ports include Bhaunagar (Bhavnagar), Veraval, Porbandar, Okha, Sika kāri and Bedi, all of which are situated on Kāthiāwār peninsula.

Chart 827.

Laccadive, Minicoy and Amindiv islands.—This group, generally known collectively as the Laccadive islands, consists of nineteen islands of which ten are inhabited. They lie about 200 miles westward of the Malabar coast and constitute a Union Territory under an Administrator, whose headquarters are at Calicut on the mainland.

Amindivi islands consist of the northern islands of the group, i.e. Amini, Kadmat, Kiltān, Bitra and Chētlat; the southern islands are sometimes collectively referred to as Cannanore islands.

The islanders are nearly all Moslems of Hindu descent; they are bold seamen and expert boat builders. In 1951, they numbered 21,035. In appearance, manners and customs they are indistinguishable, except those on Minicoy, from the Moplahs of Kerala; their dialect is old Malayalam with local variations peculiar to each island.

The Minicoites are more akin to the inhabitants of the Maldives, and their language, Mahl, is said to be allied to primitive Sinhalese. In appearance, customs and manners they are strikingly different from the inhabitants of the other islands.

The major source of income of the islands is through the sale of coir; this is bought entirely by the Government in exchange for rice. Fishing is being developed on a fairly large scale, particularly on Minicoy.

The climate of the Laccadives has been stated to be healthy; the main problem is the eradication of leprosy and filariasis. Leprosy occurs on Minicoy and Androth, on both of which there are leper colonies.

There are Government dispensaries on most of the inhabited islands.

Chart 784b.

REPUBLIC OF PAKISTAN.—By the Indian Independence Act, 1947, Pakistan became a self-governing and independent member of the British Commonwealth of Nations on July 18th, 1947. On March 23rd, 1956, Pakistan was proclaimed an Islamic republic whilst still continuing full membership of the Commonwealth.

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Chart 784b.

The Republic of Pakistan consists of the two geographical units of West Pakistan and East Pakistan situated north-westward and north-eastward, respectively, of the Republic of India and separated from each other by about a thousand miles of Indian territory. Part of West Pakistan only is covered by this volume.

Pakistan covers an area of about 364,737 square miles and had, in 1951, a total population of 75,842,135. Over 85% of the population are Moslems.

Urdu and Bengali are the two main languages of Pakistan. English is the official language.

In 1960, Rawalpindi was proclaimed the Capital of Pakistan in place of Karāchi, which became a Federal Territory.

Government.—The executive authority is exercised by the President assisted by a cabinet of Ministers of State. The legislative power is vested in a Constituent Assembly.

Currency.—The monetary unit is the Pakistan rupee sub-divided into 100 paisa. It is equivalent to about 1s. 6d. sterling.

Currency notes of the values of one rupee, 2, 5, 10 and 100 rupees are in circulation. Coins with values of one rupee, one, 5 and 10 paisa are legal tender.

Weights and measures.—The principal units in all the scales of weights are the maund, seer and tola, for which the standard weights are 82·27 lbs., 2·057 lbs. and 180 grains troy, respectively. There are 40 seers in a maund.

Chart 826.

West Pakistan.—West Pakistan comprises the former provinces, states and areas to the north-west of the Republic of India, which became part of Pakistan on the passing of the Indian Independence Act, 1947; of these the former province of Sind, which fronts the Arabian sea between the Indian-Pakistan frontier and Cape Monze (*Lat. 24° 50′ N., Long. 66° 40′ E.*), is the only one covered by this volume. For aministrative purposes West Pakistan is divided into 10 Commissioners' divisions.

West Pakistan has an area of 309,424 square miles and, in 1958, had an estimated population of about 37,396,000. The capital is Lahore.

Apart from the northern and western areas, which are covered with great mountain ranges, the whole province consists of a fertile plain watered by the River Indus and its tributaries. Agriculture, which is dependent almost entirely on the irrigation system based on these rivers, is the occupation of the vast majority of the population.

River Indus and its tributaries Jhelum, Chenab, Ravi and Sutlej rise in the Himalayas. Indus river, after flowing south-south-westward for some 1,800 miles reaches the Arabian sea through many mouths between Karāchi and the eastern frontier of West Pakistan; its delta, described on page 328, is extensive and occupies the whole of this stretch of coast.

The mouths of the Indus are subject to frequent and great changes during the floods, which are caused by the melting of the snows in the Hindu Kush and Himalayas; these floods start at the end of March and continue until the end of September, having attained their maximum in the first week of August. Due to the shifting channels and sandbanks caused by the floods and the arid nature of the country through which it flows, the River Indus is of comparatively little value as a highway for traffic.

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Chart 826.

Products.—West Pakistan is a rich wheat-producing area. There are large deposits of rock salt, which, together with cotton, forms the main exports of the province. Of other crops rice, grain, jowar and oil-seeds are the most important.

Communications.—Karāchi is the only port of West Pakistan covered by this volume, and is the main air terminus of the province; its communication facilities are described on page 342.

Internal air services and the railway link most of the larger cities and towns.

Within the area covered by this volume, the principal and most of the smaller towns are connected with the general telegraph and telephone systems.

Charts 826, 827.

PORTUGUESE POSSESSIONS.—Portuguese possessions on the Indian peninsula consist of the colony of Goa with the islands of Anjidiv (Anjediva), San Jorge (San George) and Morcêgos (Ilhéu Pequena) on the Malabar coast; the territory of Damān on the Gujarat coast at the entrance to the Gulf of Cambay; and the small island of Diu with the coastal tracks of Gogola and Simbor on Kāthiāwār peninsula.

These possessions cover about 1,500 square miles and, in 1950, they had a population of 637,591.

In 1958, 873 vessels with a total gross tonnage of 2,216,365 used the ports in these Portuguese possessions.

Goa.—Goa lies between latitudes 14° 53′ N. and 15° 43′ N., and longitudes 73° 45′ E. and 74° 24′ E. It is bounded on the south by the State of Mysore, on the east by the Western Ghāts, and on the north by Rio Terekhol (Tirakul river), separating it from Maharashtra State. The extreme length of the settlement is 62 miles in a northerly and southerly direction, and its greatest breadth 40 miles.

Panjim, near the town of Old Goa, is the capital of Portuguese territories in India, and the centre of trade and government.

Goa is a hilly country; its distinguishing feature is the Western Ghāts, which branch off westward across the territory into numerous spurs and ridges. These mountain ranges are studded with isolated peaks, some of the most important of which are Sonsagar and Vaguerim, and near the coast, at the southern end of the territory, Monte de Canacona (Canacona peak) and East peak, which are conspicuous from seaward.

The most important navigable river is Rio de Mandāvi, which flows into Enseada da Agoada. Panjim lies on its southern bank, about 1½ miles from the entrance.

Damān.—The territory of Damān, between the States of Maharashtra and Gujarat, has a total area of 149 square miles, and consists of three detached portions:—Damān proper, containing 22 square miles; Dadra, a very small enclave; and Nagar-Aveli, which contains 112 square miles.

The coast is generally low, the only hills being in Nagar-Aveli and they do not exceed an elevation of 800 feet (243m8).

Damān (*Lat. 20° 24′ N., Long. 72° 50′ E.*), the chief town, is situated on both sides of the entrance to Rio Damānganga (Daman Gunga river). It has two forts in one of which are the Governor's palace and the Government officer.

Rio Damānganga is the only river of any importance; it is navigable

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Charts 826, 827.

by small boats as far as Calacaxigao, about 3 miles from the entrance.

Diu.—The island of Diu (*Lat. 20° 43′ N., Long. 70° 57′ E.*), with a harbour at its eastern end, lies off the south coast of Kāthiāwār peninsula.

Atlas of Indian Ocean currents.

CURRENTS.—The seasonal alternations of atmosoheric pressure over the continent of Asia give rise to the south-west and north-east monsoons. In the northern part of the Indian ocean the monsoons develop seasonal surface currents in opposite directions, according to the time of year. The only current northward of the equator not so reversed is the east-going Equatorial countercurrent, which extends a few degrees north from the equator, though it lies mainly southward of it.

Owing to the coastal conformation of the Arabian sea and the Bay of Bengal, the current in coastal waters sets in a clockwise direction during the south-west monsoon, and in a counterclockwise direction during the height of the north-east monsoon, in December to January. It is thus only in the more open parts of the Arabian sea and Bay of Bengal that the current takes the direction of a drift current due to the monsoon blowing at the time. This direction is easterly during the south-west monsoon and westerly during the north-east monsoon.

During the later part of the north-east monsoon period, March to April, when the monsoon is weakening, the current circulation of the Arabian sea and Bay of Bengal has a special character, differing from that of either of the two main monsoon periods. The south-west monsoon circulation is established from May to September. October is a month of transition and, to some extent, so are February and March. The currents of the Arabian sea are therefore described below for the three periods, December to January, March to April and May to September. The circulation for these three periods is shown in *Figures 1, 2 and 3.*

North-east monsoon.—*November to January.*—In the open waters of the Arabian sea the general set of current is westerly. Owing to the coastal conformation, the current off the west coasts of India and West Pakistan and off the south-east coast of Arabia flows in a counterclockwise direction. This flow continues southward along the east coast of Africa from southward of Cape Guardafui to about latitude 3° S., being there known as the East African coast current. Onshore sets, with drifts up to 4 knots, are possible from southward of Cape Guardafui to the equator, particularly between latitudes 5° and 10° N. This current, between about latitudes 2° N. and 4° S., turns eastward to form the beginning of the east-going Equatorial countercurrent.

The predominant direction of the current off the west coast of the Indian peninsula to about latitude 20° N. is therefore north-north-westerly. It then turns north-westerly, becoming west-north-westerly along the coast of West Pakistan westward of Cape Monze (*Lat. 24° 50′ N., 66° 40′ E.*). Off the south-east coast of Arabia it is south-westerly.

February to April.—The predominant flow in the open waters of the Arabian sea is westerly or north-westerly.

About the end of January, the counterclockwise coastal circulation of November to January ceases, and a coastal current in the opposite (clockwise) direction is gradually established. Thus the coastal circulation is reversed in direction while the north-east monsoon is still

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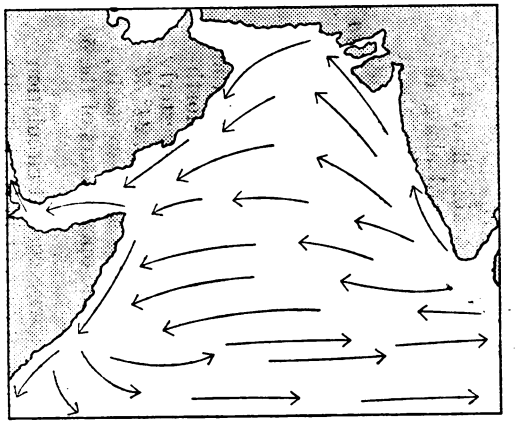
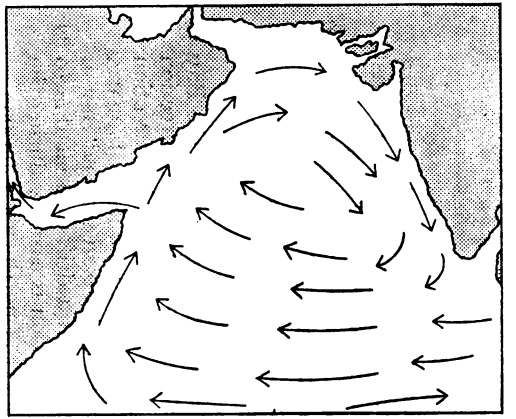
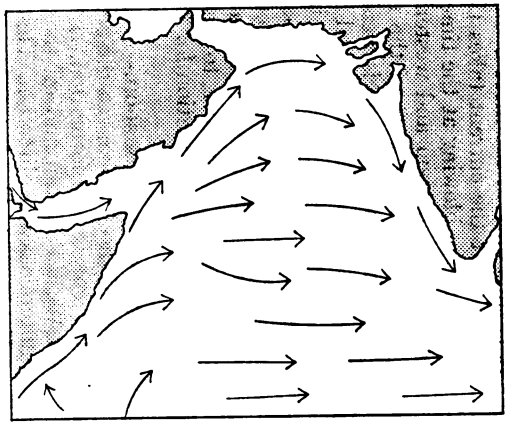


December to January. Figure 1.



March to April. Figure 2



May to September. Figure 3.

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blowing. The monsoon, however, begins to decrease in force, especially from the beginning of March.

On the average, the reversal of the coastal current is not simultaneous along all parts of the coast. Along the African coast, the East African coast current northward of latitude 5° N. is reversed to a north-north-easterly direction by March, and is completely reversed during April, though the north-east monsoon prevails there until the end of March, and the south-west monsoon does not make until May. Off the south-east extremity of Arabia, the current changes from south-west to north-east during April. South-westward of Cape Monze, the current changes from west-north-west in January to west-south-west in February and south-south-east in March, becoming east-south-east in April. Off the Indus delta the current is setting south-easterly in February. Further southward, off the west coast of the Indian peninsula the reversal to a south-south-east direction occurs by the end of February. On this coast the south-west monsoon is not established until June.

The periods of change given above are based on the available current observations, which at present are only in moderate number. For this reason, and also since currents in the monsoon areas show a considerable degree of variability in all seasons, it is likely that occasional currents in a clockwise direction in the coastal region may be met before the dates mentioned.

Onshore sets, with rates up to 3 knots, are possible in April off the coasts of Arabia and West Pakistan, westward of Cape Monze. The risk is present, to a lesser extent, in February and March.

The reversal of the coastal current of the Arabian sea during the later part of the north-east monsoon period is attributed to the formation of a gradient current. The effect of the north-east monsoon blowing in strength from November to January is gradually to cool the water at the head of the sea relatively to that further southward. In this way a temperature difference of about 6° Fahrenheit is reached by the end of January between the water at the head of the Arabian sea and that in latitudes 10° to 12° N. This produces a very slight slope of the water downwards to the head of the sea. The temperature difference is maintained to the end of March, when it begins to decrease. There is also a difference along the parallels of 10° to 12° N., the sea temperature decreasing from the Indian peninsula to the African coast. The effect of the earth's rotation and these sea temperature gradients give rise to clockwise currents around the northern half of the Arabian sea.

At about the time when the gradient current might be expected to decrease, from the diminishing temperature difference, the south-west monsoon arrives and strengthens the clockwise coastal circulation as a normal current resulting from the wind.

South-west monsoon.—*May to September.*—About the time when the south-west monsoon breaks, the East African coast current, already running in a northerly direction, greatly increases in strength and constancy. The clockwise coastal circulation of the Arabian sea is also strengthened. By the time the monsoon has spread over the sea, the surface current in open water is flowing on a general easterly direction everywhere northward of the west-going Equatorial current southward of the equator, i.e. the Equatorial current northward of the equator is reversed. There is thus at this season no distinction of direction between the east-going monsoonal current and the east-going

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Equatorial countercurrent. The countercurrent is indicated however by the greater strength of current usually experienced southward of about latitude 2° N. in the longitudes of the Arabian sea.

The bulk of the East African coast current turns eastward, away from the coast between latitudes 7° and 10° N., and passes southward of Socotra into the general easterly current. Some water also branches seaward from the East African coast current between the equator and latitude 7° N. The current southward of Socotra in July to September is probably the strongest in the world, in the open ocean, rates up to 7 knots having been recorded. The remainder of the East Africa coast current continues along the coast to Cape Guardafui and thence across the mouth of the Gulf of Aden as part of the clockwise coastal circulation. Where this current impinges on the west coast of India, approximately between latitudes 10° and 20° N., onshore sets with rates of up to 3 knots, may be experienced.

Variability of current.—The monsoonal drifts in the open ocean show a large amount of variation of direction, so that occasional currents setting towards any part of the compass may be experienced. The total number of currents setting between north-east and south-east during the south-west monsoon varies from rather less than 50% of all currents observed to considerably more than 50%, according to the month and position considered. The total number of currents setting between north-west and south-west during the north-east monsoon is in general less than 50% of the whole, except off the south-east coast of Arabia and in the region southward of Socotra, between longitudes 52° and 60° E. The clockwise coastal current of the Arabian sea, during the south-west monsoon, appears to be the most constant in direction.

Strength of current.—Strong currents occur in the marginal parts of the region covered by this volume. Of these, those experienced southward and eastward of Ceylon are described below. The very strong currents experienced in the coastal area of the East African coast current and the region southward of Socotra during the south-west monsoon are described in Africa Pilot, Volume III.

Occasional currents up to about 3 knots may be experienced in the east-going Equatorial countercurrent at all seasons.

The strength of the monsoonal current of the Arabian sea during the north-east monsoon, both in the open ocean and in the coastal circulation, is not great, only a small percentage of the currents exceeding the rate of one knot.

The strength of the south-west monsoon currents is greater, and a considerable proportion of the currents attain rates of up to 2 knots, except off the coasts of India and West Pakistan northward of latitude 22° N., at the head of the sea. Currents up to 3 knots are occasionally experi nced, especially in the western part of the sea and off the south-east coast of Arabia.

Currents off Ceylon.—Ceylon is a meeting or dividing point for the current systems of the Indian ocean, the Arabian sea and the Bay of Bengal. In depths of less than 100 fathoms (182^{m}9), or within a distance of from 12 to 15 miles of the coast, the currents are very variable and may be experienced, on either the eastern or western sides of the island, setting parallel to the coast. These may be in opposite directions, at the same time, and within a few miles of one another.

Further offshore, the general flow of current is as follows. From November to January the current sets in a southerly direction fairly

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strongly along the east coast and less strongly along the west coast, turning, southward of the island, into the general westerly monsoonal current. Rates, off the east coast, are one to 3 knots, with a considerable risk of onshore sets; rates are slightly less off the west coast. In February and March the westerly set southward of the island persists, but the current runs north-westward and northward off the east coast from February to April, forming the beginning of the clockwise set round the coastal region of the Bay of Bengal. Currents at this time are variable and complex but not usually dangerously strong in the Gulf of Mannar, Pamban pass and Palk strait. From May to October the set is southward and south-eastward along the east and south-west coasts, turning into the general eastly monsoon current which flows south of the island. South-easterly sets with rates up to 3 knots are experienced off the south-west coast with at times a strong flow branching off into the Gulf of Mannar and on into Palk strait.

Southward of Ceylon, the change from easterly monsoon current to westerly monsoon current takes place very suddenly about the end of October. The change from the westerly current to the easterly one is more gradual, April being the transition month, when currents in both directions occur.

The region immediately eastward and southward of Ceylon is noted for strong currents, especially from June to December inclusive, when currents exceeding 4 knots may be experienced. Off the east coast of Ceylon a southerly current slightly exceeding 4 knots was recorded in October 1947.

The currents off the west coast are less well-known than those off the east and south coasts. In the south-west monsoon a strong current sets northward over Adam's Bridge (*Lat. 9° 05′ N., Long. 79° 34′ E.*). During the rest of the year the currents are probably variable.

Effect of a tropical revolving storm on the current.—In the vicinity of a tropical revolving storm, the set and drift of current may be markedly different from that normally to be expected. Comparatively little is known about such currents, particularly near the centre of the storm, since navigators avoid the centre whenever possible and conditions within the storm field generally are unfavourable to the accurate observation of current.

The primary cause of the currents is the strong wind associated with the storm. The strength of current produced by a given force of wind varies with latitude and is greatest in low latitudes. For the latitudes of tropical storms, say 15° to 25°, a wind of force 10 would produce a current of about one knot. It is believed that the strength of the currents of tropical storms is, on the average, the same as that which wind of similar force, unconnected with a tropical revolving storm, would produce. These currents, at the surface of the water, set at 45° to the right of the wind direction (in the northern hemisphere) and therefore flow obliquely outward from the storm field, though not radially from the centre.

Unless due allowance is made for these sets, very serious errors in reckoning may therefore arise. It is reported that, in one case, a vessel experienced a south-easterly set of more than 50 miles, under conditions when the set normally to be expected was south-westerly. In another case, an unexpected south-south-westerly set of 60 miles was experienced in 18 hours. These are examples of currents of abnormal strength, which are occasionally met in the vicinity of tropical revolving storms, and which cannot be accounted for by the wind strength. The

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possibility of such an experience should be borne in mind, particularly near, say within 100 miles of the centre of, the storm.

Other currents, not caused directly by the wind, may flow in connection with these storms but are probably weak and therefore negligible in comparison with the wind current.

The foregoing remarks apply to the open ocean. When a tropical storm approaches or crosses an extended coastline, such as that of Florida, a strong gradient current parallel to the coast will be produced by the piling up of water against the coast. The sea-level may rise by as much as from 8 to 15 feet (2^{m}4 to 4^{m}6) on such an occasion.

Whether the storm is in the open ocean or not, there is a rise of sea-level inwards to its centre which compensates for the reduction of atmospheric pressure. The extent of this rise is never great, from one to 2 feet (0^{m}3 to 0^{m}6) according to the intensity of the storm. It produces no current so long as the storm is not changing in intensity. If the storm meets the coast, however, the accumulation of water at its centre will enhance the rise of sea-level at the coast and so produce a stronger gradient current along the coast.

Charts 826, 827.

TIDAL STREAMS.—Southward of Mount Delly (*Lat. 12° 02′ N., Long. 75° 12′ E.*), the flood tidal stream is just appreciable as coming from the north-westward, and off Cochin it is plainly so.

Along the Konkan coast the flood stream sets northward, and strongly so off Port Bánkot; its strength increases with the latitude as far as the Gulf of Cambay.

Along the south and west coasts of Kāthiāwār peninsula the flood stream sets eastward between the Gulf of Cambay and Porbandar and northward to the north of Porbandar. It has been found to set eastward at a rate of from one to 1½ knots off Diu head, where there are frequent eddies, doubtless caused by the tidal stream during the ebb in the Gulf of Cambay setting westward while the flood stream at Porbandar is setting eastward.

Where evaporation is so great, as it is in the Indian ocean, there are doubtless some local movements of the ocean water dependent upon that cause; where the rise of tide is great, as in the Gulf of Kutch, this cause may be little appreciated, but at Cochin the flood stream has been known to be constant for 20 hours, although the regular, but inconsiderable, rise and fall of little more than one foot (0^{m}3) has been marked on the tide gauge.

Chart 748b.

SOUNDINGS.—The 100-fathom (182^{m}9) line along the west coasts of Ceylon, India and West Pakistan is now well delineated on the charts; its steep edge is a valuable guide on approaching the land, but the nature of the bottom varies so much that but little general description can be given.

The bank of soundings bordering the whole coast of Ceylon has been found, wherever it has been sufficiently investigated, to have a remarkably steep edge, strongly marked, and forming a valuable guide when making the land in hazy weather or at night.

Between latitudes 8° 30′ N. and 9° 00′ N., in the Gulf of Mannar, and extending about 10 miles offshore, are the famous pearl banks of Ceylon, with depths of from 6 to 8 fathoms (11^{m}0 to 14^{m}6). Off Colombo a series of banks, with depths of from 10 to 17 fathoms (18^{m}3 to 31^{m}1)

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Chart 748b.

rise from general depths of about 26 fathoms (47m5), about 10 miles offshore.

Off Cape Comorin the bottom is principally sand and coral rock. Along the Malabar coast, southward of Quilon, it is principally sand and shale, with little or no mud; between Quilon and Mount Delly the mud extends out to depths of from 20 to 30 fathoms (36m6 to 54m9), and between Mount Delly and the entrance to the Gulf of Cambay the bottom is composed of mud, sand, shells and coral as far as the 100-fathoms (182m9) line.

LUMINOSITY OF THE SEA.—The peculiar luminosity of the sea frequently observed in the Red sea and Gulf of Aden is reported to have been observed as far eastward as the coast of Kutch district. At 2200 on July 31st, the night being very dark, and a strong monsoon blowing, with a high sea, the horizon became suddenly very clear, and a white bank from right ahead appeared to be rushing towards the ship. A little later the sea was a sheet of pure white, which lit up the surroundings to the brilliancy of a full moon. It lasted until 0200, when it gradually faded away.

This phenomenon occurs in the open sea as well as near the land, and either in calm or stormy weather. It may cause alarm to a stranger unacquainted with it by giving him the impression that his vessel is amongst breakers.

It is probably caused by the presence of confervæ or other organic matter in the water.

The following account of such a phenomenon by Mr. H. Bradley, Master of the *Ariosto*, is of interest:—

"At 7.30 p.m., on the 17th of February, 1912, in latitude 23° 37′ N., longitude 67° 20′ E., 19 miles off the nearest point of land on the coast of Kutch, also 127 miles N.W. of the town of Dwárka, on the Káthiáwár coast, the weather at the time being very fine, with a clear and cloudless sky, full of stars, sea smooth, wind moderate, breeze from N.W., the ship steaming 9½ knots, and perfectly steady, steamed into the most curious and weird atmospheric phenomenon it has been my lot to see in all my 40 years' experience of a sea life. As we approached it, it had the appearance of breakers on a low beach, but when we got into it, it looked, at first, like flashes of light (not bright) coming from all directions in quick time. After some few minutes of this the flashes assumed a lengthened shape, following quickly one after the other from the north, and these continued for some minutes, steadily veering to east and south, and to S.W. into N.W. All the time this was going on, the surface of the sea appeared to be violently agitated, at times very high seas, as if they would completely engulf the ship, the imagined waves always going in the same direction as the waves of light, and at the time the waves of light were from opposite direction. At the same time the sea appeared like a boiling pot, giving one a most curious feeling—the ship being perfectly still, and expecting her to lurch and roll every instant. It turned me dizzy watching the moving flashes of light, so that I had to close my eyes from time to time. We were steaming in this for 20 minutes, and then passed out of it. The same appearance on leaving it as we saw approaching it, as of breakers on a low beach, and for 20 minutes everything around assumed its normal condition, a beautiful fine, clear, and cloudless night.

"At the end of this time we again saw the same thing ahead of the ship; and in a few minutes were fairly amongst it again, but if any-

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Chart 748b.

thing slightly worse, the waves of light acting in a precisely similar manner, this second lot lasting about 15 minutes, when we again steamed out of it, and saw nothing more all the night until our arrival off Karāchi, at 2.30 a.m. on the 18th. When the flashes of light passed over, the sea appeared just for the instant of time to be full of jelly-fish, but I do not think there were any about.

"I have seen the 'White water' many times in the Arabian sea, but this did not appear like that in any way; it gave one the idea of the cinematograph without the brightness, the flashes being so quick in their movements."

A similar phenomenon was witnessed by H.M.S. *Hermes* on the 13th February, 1928, in the open sea, in latitude 10° 40′ N., longitude 59° 35′ E., and by H.M.S. *Terror* on the night of the 17th of December, 1933, in latitude 18° 29′ N., longitude 70° 58′ E.

STORM SIGNALS.—The system of storm warnings, at ports embraced by this volume, consists briefly of a:—

(1) General system of eleven signals, two of which indicate the existence of distant disturbed weather, eight indicate that local bad weather threatens the port, and the remaining one indicates that communication with the Meteorological Department has broken down and that, in the opinion of the local officer, there is danger of bad weather.

(2) Brief system, consisting of five only of the above signals. This system is used at ports frequented mainly by smaller vessels engaged in local traffic.

The system in force at each port where storm signals are displayed will be found in the body of this volume.

The Meteorological Departments of Ceylon, India and Pakistan keep port officers informed of all necessary warnings and the latest information with respect to disturbances in the seas off the coasts of the Indian peninsula. Ships' officers may therefore apply to the port officers for details, to supplement the indications of the signals displayed; they will also receive detailed information in the broadcast weather bulletins issued by the Meteorological Departments through the coastal wireless stations.

I.—GENERAL SYSTEM

(a) **Distant signals.**—These indicate that vessels may be exposed to danger after they have left the harbour.

No. of signal	*Day*	*Night*	*Signification*
I			*Cautionary.* There is a region of squally weather in which a storm may be forming.

This signal is shown at ports so situated with reference to the disturbed weather that a ship leaving the port might run into danger during its voyage.

If one of the later-mentioned signals is not more appropriate and has not already been shown, this signal is shown at Arabian sea ports also when a disturbance from the Bay of Bengal is crossing the peninsula and may develop into a cyclone after entering the Arabian sea.

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No. of signal	*Day*	*Night*	*Signification*
II			*Warning.* A storm has formed.

This signal is shown when there is no immediate danger of the port itself being affected, but ships leaving the port might run into the storm.

But if, in addition to such distant warnings, there is risk of the port experiencing bad weather, the appropriate local signals are shown in preference to distant signals. For instance, if a port is threatened by squally weather, although the storm centre is far away from it, the Local Cautionary signal, III, will be shown instead of the Distant Warning signal, II. In general, if the weather situation warrants either of two or three signals, then the highest-numbered signal will be shown.

(b) **Local signals.**—These indicate that the port itself and the ships in it are threatened.

No. of signal	*Day*	*Night*	
III			*Cautionary.* The port is threatened by squally weather.
IV			*Warning.* The port is threatened by a storm, but it does not appear that the danger is as yet sufficiently great to justify extreme measures of precaution.

The existence of a storm can often be determined before its direction of motion can be fixed. In this case all those ports which the storm could possibly strike are warned by this signal.

V			*Danger.* The port will experience severe weather from a storm, of slight or moderate intensity, that is expected to cross the coast southward of the port (or eastward in the case of Veraval).
VI			*Danger.* The port will experience severe weather from a storm, of slight or moderate intensity, that is expected to cross the coast northward of the port (or westward in the case of Karāchi).

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No. of signal	Day	Night	Signification
VII			*Danger.* The port will experience severe weather from a storm, of slight or moderate intensity, that is expected to cross over or near the port.
VIII			*Great danger.* The port will experience severe weather from a storm of great intensity that is expected to cross the coast southward of the port (or eastward in the case of Veraval).
IX			*Great danger.* The port will experience severe weather from a storm of great intensity that is expected to cross the coast northward of the port (or westward in the case of Karāchi).
X			*Great danger.* The port will experience severe weather from a storm of great intensity that is expected to cross over or near the port.
XI			*Failure of communications.* Communications with the Meteorological Warning Centre have broken down, and the local officer considers that there is danger of bad weather.

II.—BRIEF SYSTEM

In the Brief system only one of the five following signals is shown, and the port officers are kept informed of the prospects of local bad

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weather associated with any disturbance in the sea, for the general information of shipping.

Signal No. III.—Cautionary
Signal No. IV.—Warning
Signal No. VII.—Danger
Signal No. X.—Great Danger
Signal No. XI.—Failure of communications

} Meaning the same as day and night signals in the General system.

Storm signal stations.—Within the area covered by this volume there are storm signal stations at the following places:—

Agoada, Enseada de	Hárnai	Navlakhi, Port
Alibāg	Honāvar (Honāwar)	Nawābandar
Alleppey	Jáfarabad	Okha
Arnāla island	Jaigarh	Pamban
Azhikal (Azhikkal)	Janjira harbour	Ponnáni
Badagara	Jaytápur (Jaitapur)	Porbandar
Bhatkal	Kandla	Ratnágiri
Bhavnagar (Bhaunagar)	Karāchi	Rozi island
Bombay	Kārwār	Satpati
Calicut	Kumta (Kumpta)	Tārāpur
Cannanore	Kundapur	Tellicherry
Cochin	Māhīm	Tuticorin
Dabhol, Port	Malpe	Vengurla
Dāhānu	Malvan	Veraval
Damān	Māndvi	Vesāva island
Deogarh	Mangalore	Vijaydurg (Vijayadurg)
Diu	Mángrol	
Dwárka	Mormugão, Pôrto de	

The following places receive reports of storm warnings but hoist no signals:—

Ankola	Kallāyi	Murdeshwar (Modeshwar)
Baindūr	Kāsaragod	Panvel
Bassein	Kolachel	Quilon
Bhayandar/Utan	Kolak (Koluck)	Revadanda
Broach	Mahé	Rupān bandar
Bulsar	Malgund (Malgom)	Surat
Cambay	Minicoy island	Thāna
Dhanushkodi	Mora/Uran	Trivandrum
Gokarn	Mūlki	Umbargaon
Hangarkatta (Hangarkota)		

SIGNALS.—Signals to be made by vessels approaching ports when inconvenienced by searchlights.—In the event of the navigation of a vessel being inconvenienced by the glare from searchlights near a port in the British Commonwealth, she should make the International Code signal ZO (— — ·· — — —) by lamp and by whistle, siren or fog-horn.

Both the light and sound signals should be employed, whenever possible, and should be repeated until the inconvenience is removed.

Only real urgency should necessitate the use of this signal, as unless the vessel is actually in the rays of a searchlight, it is not possible for the operators to know which projector is affected.

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This signal is designed to assist mariners; no liability whatever will be admitted.

This signal should also be used in similar circumstances near ports in other countries.

Pakistan vessels.—Not under command signals.—Pakistan naval vessels and tugs engaged in towing will display "Not Under Command" lights and shapes when:—

(i) The Towing Master considers the tow to be a danger to shipping owing to its failure to follow reasonably or for any other reason.

(ii) Owing to the nature of the tow or sea-room available, the towing vessel is unable to take full avoiding action as required by the International Regulations for the Prevention of Collisions at Sea.

(iii) The lights or position of the tow cannot be seen from the towing vessel owing to low visibility.

(iv) An un-manned tow is likely to sheer badly. The lights and shapes will be displayed from the commencement of the tow.

Quarantine.—*See* page 29.

SIGNAL STATIONS.—Signal stations are established at the following places mentioned in this volume:—

Agoada, Morro da	Colombo	Mangalore
Alleppey	Damān	Mormugão, Pôrto de
Bombay	Diu	Panjim
Calicut	Kandla	Tellicherry
Cannanore	Karāchi	Tuticorin
Cochin	Koilthottam	Vengurla
		Veraval

For details, *see* under station concerned.

RADIO STATIONS.—The following coastal radio stations in the area covered by this volume are open for public correspondence:

Ceylon.—Colombo.

India.—Bombay, Cochin, Kandla, Kārwār, Mangalore, Ratnágiri, Tuticorin.

Portuguese territories.—Ilha de Goa.

West Pakistan.—Karāchi.

For details, *see* list published by the General Secretariat of the International Telecommunication Union.

For details of radio stations which transmit weather bulletins, storm signals, navigational warnings, time signals, etc., *see* Admiralty List of Radio Signals, Volume V.

BUOYAGE SYSTEMS.—Republic of India.—The Uniform System of Buoyage is generally adopted in the Republic of India, except in special areas where full particulars will be found in the appropriate place in the text.

The four coloured plates facing this page illustrate the Uniform System of Buoyage as agreed at the London Conferences of 1933 and 1936. The following paragraphs give details of this system as applied by the Indian authorities.

The mariner approaching the coast, having fixed his position, must note the direction of the main flood stream. *See* page 18.

The term "starboard hand" shall denote that side which would be on the right hand of the mariner either going with the main flood stream or approaching a harbour, river or estuary from seaward. The term

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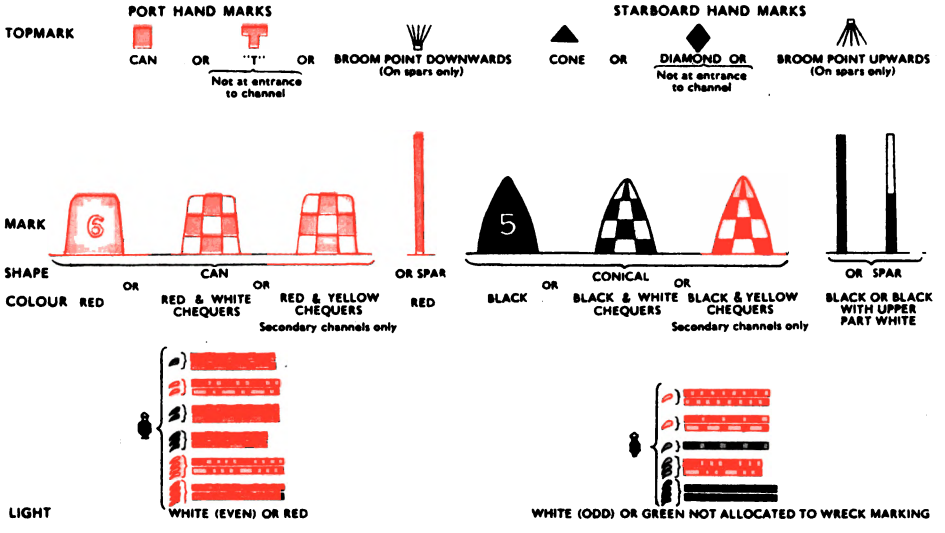
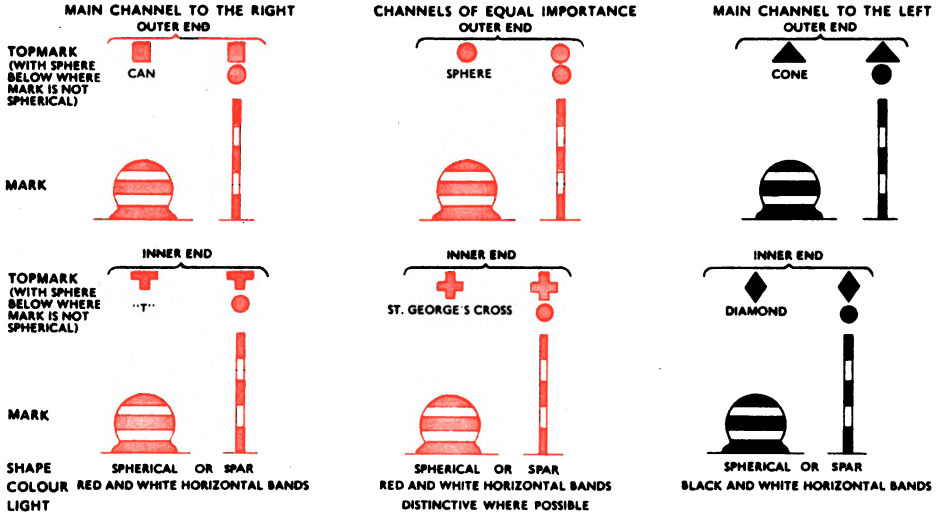
DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

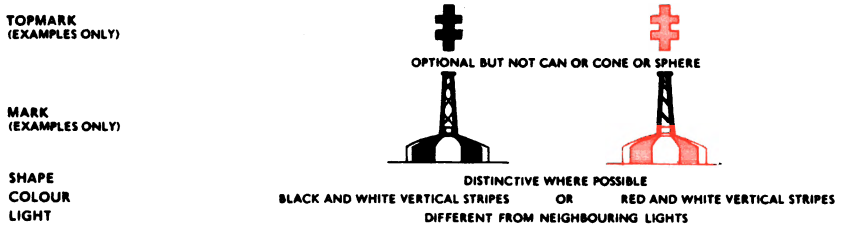
LATERAL SYSTEM



MIDDLE-GROUND OR BIFURCATION OR JUNCTION MARKS



MID-CHANNEL MARKS



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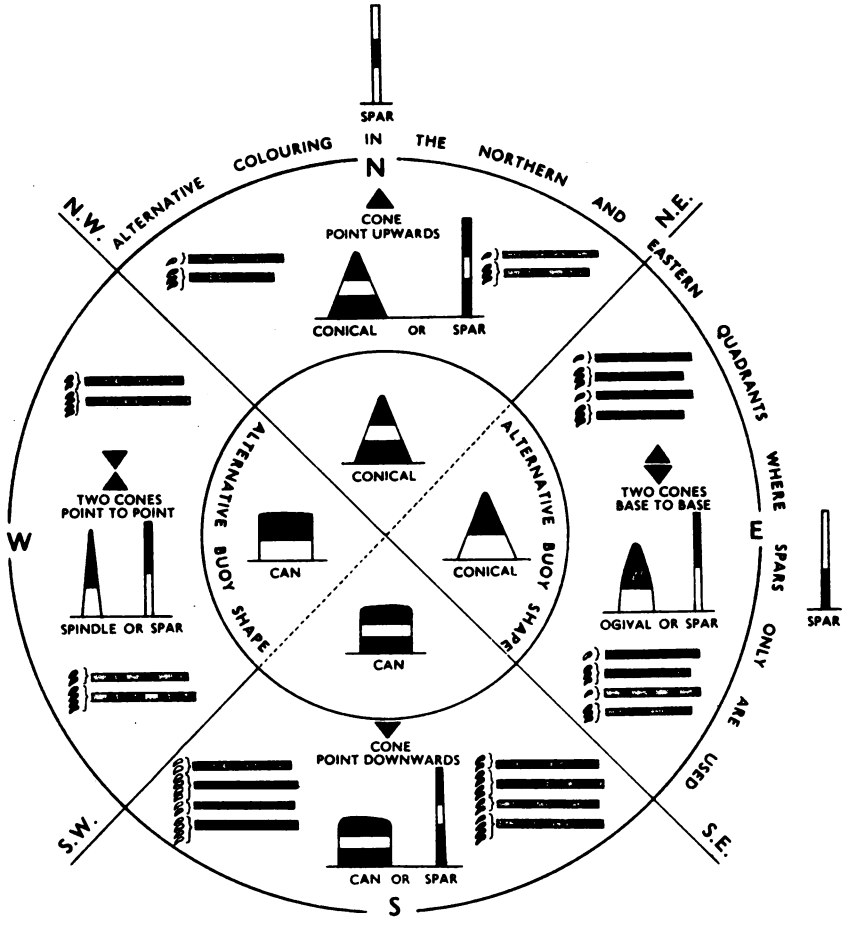
DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

CARDINAL SYSTEM



NOTE. SLIGHT MODIFICATIONS IN MINOR DETAILS TO THE ABOVE HAVE BEEN INTRODUCED BY CERTAIN COUNTRIES

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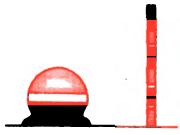
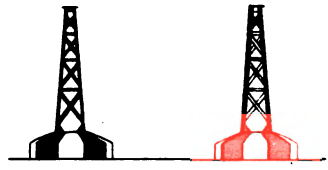
DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

MARKS COMMON TO BOTH SYSTEMS AND OTHER MARKS

	ISOLATED DANGER MARKS	FAIRWAY MARKS
TOPMARK	SPHERE	OPTIONAL (SEE FOOTNOTE)
MARK		
SHAPE	SPHERICAL OR SPAR	OPTIONAL (SEE FOOTNOTE)
COLOUR	WIDE BLACK AND RED HORIZONTAL BANDS SEPARATED IF DESIRABLE BY A NARROW WHITE BAND	BLACK AND WHITE VERTICAL STRIPES OR RED AND WHITE VERTICAL STRIPES
LIGHT	FLASHING (WHITE OR RED)	FLASHING

	TRANSITION MARKS	QUARANTINE-GROUND MARKS
TOPMARK	OPTIONAL (SEE FOOTNOTE)	
MARK		
SHAPE	OPTIONAL (SEE FOOTNOTE)	OPTIONAL (SEE FOOTNOTE)
COLOUR	RED AND WHITE DIAGONAL STRIPES OR BLACK AND WHITE DIAGONAL STRIPES	YELLOW

	OUTFALL AND SPOIL-GROUND MARKS	AREAS USED FOR NAVAL MILITARY, OR AIR FORCE PRACTICE PURPOSES
MARK		
SHAPE	OPTIONAL (SEE FOOTNOTE)	OPTIONAL (SEE FOOTNOTE)
COLOUR	YELLOW ABOVE AND BLACK BELOW	WHITE WITH BLUE CROSS

FOOTNOTE. SHAPE IS OPTIONAL AND THE ILLUSTRATIONS ARE TO BE REGARDED AS EXAMPLES ONLY THE ONLY DEFINITE REQUIREMENT IS THAT THE SHAPE ADOPTED SHALL NOT BE MISLEADING

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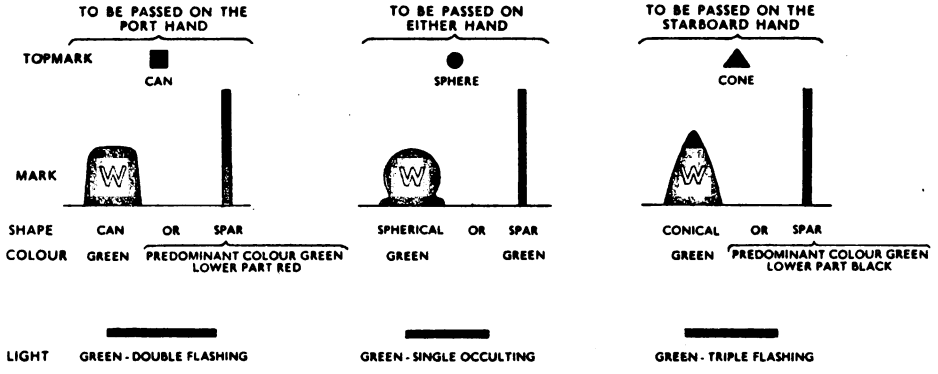
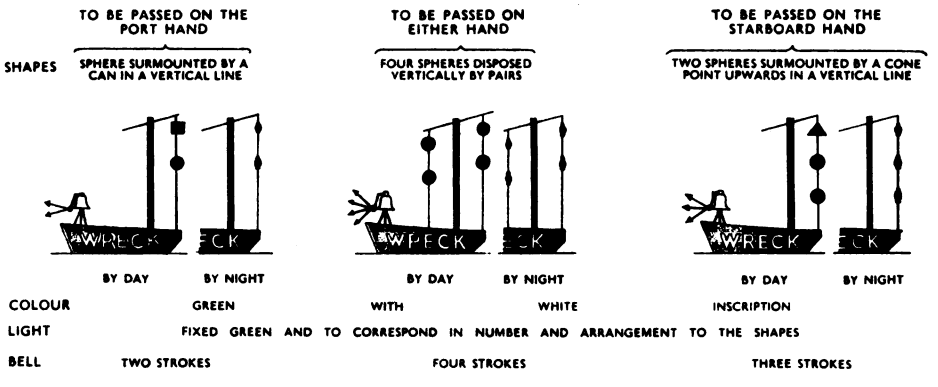
DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

MARKING OF WRECKS

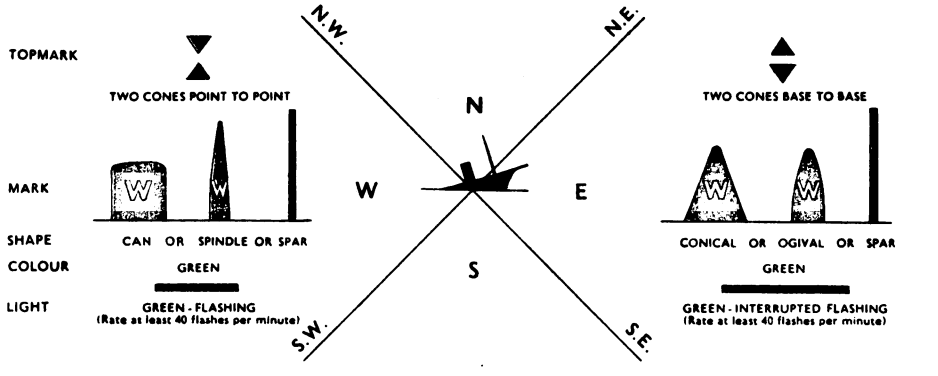
LATERAL SYSTEM
BUOYS



VESSELS



CARDINAL SYSTEM



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"port hand" shall denote the left hand of the mariner in the same circumstances.

Buoys marking the same side of a channel, estuary or tide-way may be distinguished from each other by names, numbers, commencing from seaward odd to starboard, even to port, or letters.

Starboard hand buoys.—Starboard hand buoys are conical in shape and painted black or black and white in chequers. The topmark (if any) is a black cone or, for purposes of differentiation except at the entrance to a channel, a black diamond. If lit, a *white flashing* light, having *one, three* or *five* flashes, is exhibited.

Port hand buoys.—Port hand buoys are can-shaped and painted red or red and white in chequers. The topmark (if any) is a red can, or, for purposes of differentiation except at the entrance to a channel, a red T. If lit, a *red flashing* light, having *any number* of flashes *up to four* or a *white flashing* light having *two, four* or *six* flashes is exhibited.

Middle ground buoys.—Middle ground buoys are spherical in shape; if the main channel lies to starboard, or if the channels are of equal importance, they are painted in red and white horizontal bands; if the main channel lies to port they are painted in black and white horizontal bands. When topmarks are carried, if the main channel lies to starboard the outer end buoy is distinguished by a red can, and the inner end buoy by a red T: if the main channel lies to port the outer end buoy is distinguished by a black cone, and the inner end buoy by a black diamond; if the channels are of equal importance, the outer end buoy is distinguished by a red sphere, and the inner end buoy by a red St. George's cross. If lit, their lights are either *white* or *red* and are distinctive as far as possible; neither the colour nor the phase of the light is such as to lead to uncertainty as to the side on which the buoy must be passed.

Mid-channel buoys.—Mid-channel buoys are distinctive in shape, being neither conical, can nor spherical; they are painted black and white, or red and white, in vertical stripes. If a topmark is carried it is distinctive in shape, being neither cone, can nor sphere; if lit, their lights differ from other lights in the vicinity.

Isolated danger buoys.—Buoys marking isolated dangers are spherical in shape and are painted in wide black and red horizontal bands which are separated by a narrow white band. If a topmark is carried it consists of a sphere painted black or red, or half black and half red horizontally; if lit, they exhibit *white* or *red flashing* lights.

Landfall buoys.—These buoys are similar in shape and colour to those which may be used for making mid-channels (*see* above); if lit, they will exhibit *flashing* lights.

Miscellaneous buoys.—Buoys marking spoil grounds or sewer outfalls are not considered as navigational buoys and are generally conical painted horizontally, the upper half yellow and the lower black.

Buoys intended for moorings or other purposes not included above may be of any shape or colour, according to the discretion of the authority within whose jurisdiction they are laid, but not such as might lead to confusion with buoys whose purpose is defined above.

Buoys fitted with sound signal devices will have, if practicable, the characteristics appropriate to their position in accordance with the foregoing rules.

Cautions.—In certain cases slight modification to the above rules may be found where local circumstances make it desirable. Full

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particulars will be found in the appropriate place in the body of this volume, which should invariably be consulted.

During the south-west monsoon, from about the middle of May to the middle of September, most of the ports on the Malabar coast are virtually closed and many of the buoys are temporarily withdrawn.

Ceylon.—Goa.—Damān.—Diu.—The Uniform System of Buoyage is in force in the waters under the jurisdiction of the Government of Ceylon and in areas under Portuguese authorities.

West Pakistan.—In the waters under the jurisdiction of the Pakistan authorities, starboard-hand buoys are conical, painted red, and if lighted exhibit *red* lights. Port-hand buoys are can shaped, painted black, or parti-colour, and if lighted exhibit *green* lights.

The topmarks of middle ground buoys are spheres on the outer marks, and half spheres, round part uppermost, on the inner marks.

Wreck marks.—Throughout the area covered by this volume the Uniform Lateral System of wreck-marking (*see* colour diagram) is in force unless the authorities having jurisdiction in a particular locality, in their discretion determine otherwise.

It should be noted, however, that in Pakistan waters, *green* lights may be exhibited from light-buoys other than those marking wrecks.

AIR LIGHTS.—Mariners are warned that lights (with definite characteristics), which are not ordinary navigational aids, may be exhibited for the use of aircraft from structures near the coasts described in this volume.

These lights are often of great luminous power and elevation, and may be the first lights or looms of lights sighted when making a landfall at night; they normally have the following characteristics:—

(a) *Flashing white* (revolving beam type). These lights are usually screened from seaward but their looms may be visible.

(b) *Alternating flashing white and green* (revolving beam type).

(c) *Flashing two-letter groups* in the Morse Code, in *red* or *green*. Although the groups made by these lights may have definite meanings in the International Code of Signals, their signification is to be disregarded; the fact that they are *red* or *green* in colour, and flash with mechanical regularity, should prevent their being mistaken for signals from shore signal stations or ships.

Air lights which appear likely to be visible from seaward will be shown on charts and described in the Admiralty Lists of Lights. As they are subject to changes of which prompt notification to the mariner may not always be possible, care should be taken that they are not confused with marine navigational aids.

SUBMARINE CABLES.—The following Articles are taken from the International Convention for the Protection of Submarine Telegraph Cables of 14th March, 1884:—

Art. II. It is a punishable offence to break or injure a submarine cable, wilfully or by culpable negligence, in such manner as might interrupt or obstruct telegraphic communication, either wholly or partially, such punishment being without prejudice to any civil action for damages.

This provision does not apply to cases where those who break or injure a cable do so with the lawful object of saving their lives or their

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ship, after they have taken every necessary precaution to avoid so breaking or injuring the cable.

Art. V. Vessels engaged in laying or repairing submarine cables shall conform to the regulations as to signals which have been, or may be, adopted by mutual agreement among the High Contracting Parties, with the view of preventing collisions at sea.

When a ship engaged in repairing a cable exhibits the said signals, other vessels which see them, or are able to see them, shall withdraw to or keep beyond a distance of one nautical mile at least from the ship in question, so as not to interfere with her operations.

Fishing gear and nets shall be kept at the same distance.

Nevertheless, fishing vessels which see or are able to see a telegraph-ship exhibiting the said signals shall be allowed a period of twenty-four hours at most within which to obey the notice so given, during which time they shall not be interfered with in any way.

The operations of the telegraph-ships shall be completed as quickly as possible.

Art. VI. Vessels which see, or are able to see, the buoys showing the position of a cable when the latter is being laid, is out of order, or is broken, shall keep beyond a distance of one quarter of a nautical mile at least from the said buoys.

Fishing nets and gear shall be kept at the same distance.

Art. VII. Owners of ships or vessels who can prove that they have sacrificed an anchor, a net, or other fishing gear in order to avoid injuring a submarine cable, shall receive compensation from the owner of the cable.

In order to establish a claim to such compensation, a statement, supported by the evidence of the crew, should, whenever possible, be drawn up immediately after the occurrence; and the master must, within twenty-four hours after his return to or next putting into port, make a declaration to the proper authorities.

The latter shall communicate the information to the Consular authorities of the country to which the owner of the cable belongs.

Caution.—Cautionary notes appear on many charts, calling attention to areas in which there are submarine cables; these areas are indicated on the charts by pecked lines.

Every care should be taken to avoid anchoring in such areas, even though there may be no specific prohibition against doing so, in view of the serious interference with communications which results from damage to submarine cables.

Equal care should be taken wherever the symbol for a submarine cable (a wavy line) is shown on the chart.

Danger involved in cutting a cable to clear anchors or fishing gear.—In the event of a vessel fouling a submarine cable, every effort should be made to clear the anchor or gear by normal methods; should these efforts fail, the anchor or gear should be slipped and abandoned *without attempting to cut the cable. High voltages are, or may be, fed into certain submarine cables; serious risk exists of loss of life due to electric shock, or at least severe burns, if any attempt to cut the cable is made.* No claim in respect of injury or damage sustained through such interference with a submarine cable will be entertained.

Compensation for anchors or fishing gear sacrificed in order to avoid injuring a submarine cable can be claimed under the Submarine Telegraph Act of 1885 (Schedule of Submarine Telegraphs Convention, Article VII).

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FISHING VESSELS.—Mariners are warned that due to the expansion and development of the fishing industry in the area covered by this volume, powered fishing trawlers may be encountered offshore and near the main shipping routes.

LIFE-SAVING.—Lifeboats and life-saving appliances form the principal means adopted for saving life; the stations where these are maintained are listed hereafter and are mentioned in their appropriate places in this volume.

The line-throwing apparatus, the principal life-saving appliance, can often be used with effect when a lifeboat is not available; its success, however, depends largely upon an intelligent co-operation on the part of the crew of the stranded vessel.

Signals.—In accordance with the International Convention for the Safety of Life at Sea, 1948, Chapter V, Regulation 16, the following signals shall be used by life-saving stations when communicating with ships in distress and by ships in distress when communicating with life-saving stations:—

(*a*) *Replies from shore station to distress signals made by ship:—*

Signal	*Signification*
By day.—White smoke signal. *At night.*—*White* star rocket.	"You are seen—assistance will be given as soon as possible."

(*b*) *Landing signals for the guidance of small boats bringing away the crew of a wrecked ship:—*

Signal	*Signification*
(i) *By day.*—Vertical motion of a white flag or the arms. *At night.*—Vertical motion of a *white* light or flare. A range (indication of direction) may be given by placing a steady *white* light or flare lower and in line with the observer.	"This is the best place to land."
(ii) *By day.*—Horizontal motion of a white flag or arms extended horizontally. *At night.*—Horizontal motion of a *white* light or flare.	"Landing here highly dangerous."
(iii) *By day.*—Horizontal motion of a white flag, followed by the placing of the white flag in the ground and the carrying of another white flag in the direction to be indicated. *At night.*—Horizontal motion of a *white* light or flare, followed by the placing of the *white* light or flare on the ground and the carrying of another *white* light or flare in the direction to be indicated.	"Landing here highly dangerous. A more favourable location to land is in the direction indicated."

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(c) *Signals to be employed in connection with the use of shore life-saving apparatus:—*

Signal	*Signification*
(i) *By day.*—Vertical motion of a white flag or the arms. *At night.*—Vertical motion of a *white* light or flare.	*In general:*—"Affirmative." *Specifically:*— "Rocket line is held." "Tail block is made fast." "Hawser is made fast." "Man is in the breeches buoy." "Haul away."
(ii) *By day.*—Horizontal motion of a white flag or arms extended horizontally. *At night.*—Horizontal motion of a *white* light or flare.	*In general:*—"Negative." *Specifically:*— "Slack away." "Avast hauling."

Life-saving stations.—Lifeboats are maintained at the following places mentioned in this volume:—

Colombo:—3 power lifeboats and 3 life-saving tugs.
Bombay:—One power lifeboat.
Karāchi:—3 power lifeboats.
Rio de Sinquerim (Enseada da Agoada):—One lifeboat.

STANDARD AND SUMMER TIMES.—All information concerning standard and summer times will be found in the Admiralty List of Radio Signals, Volume V.

FUEL.—Fuel and diesel oils may be obtained at Colombo, Cochin, Bombay, Kandla and Karāchi, and fuel oil only at Okha.

Supplies of coal are available at Colombo, Cochin, Bombay and Karāchi.

For details, *see* under place concerned.

REPAIRS.—Repairs to hulls, engines, and boilers can be carried out at Colombo, Cochin, Bombay, Kandla and Karāchi. There is a dry dock at each of these ports except Kandla, where there is a floating dock; there is also a dry dock at Mandapam; the dimensions of the largest dock at each port are given in Appendix I.

QUARANTINE.—The following regulations are in force for vessels arriving at ports in Ceylon, India and West Pakistan:—

The master of every suspected or infected vessel, or of any vessel on which unusual mortality among rats has been observed, shall, on arrival at any port, hoist the appropriate quarantine signals prescribed in the International Code of Signals.

Deratisation.—In accordance with Article 17 of the International Sanitary Regulations, deratisation can be carried out, and Deratisation and Deratisation Exemption certificates can be issued to vessels, at Bombay, Colombo and Karāchi. Deratisation Exemption certificates only can be issued at Cochin, Kandla and Pôrto de Mormugão.

CLIMATE AND WEATHER.—General remarks.—All the articles on General Meteorology on pages xxxii to xlvii apply to this volume.

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Weather reports and forecasts for the area covered by this volume are issued regularly by radio from certain transmitting stations, which also broadcast warnings. Full details of the stations and of the information provided, together with frequencies and times of transmission, are to be found in the Admiralty List of Radio Signals, Vols. III and IV.

The climate of the region covered by this volume has a regular seasonal variation, and the general character of the weather is more nearly specified by the season than in most other parts of the world. For several months during the northern hemisphere summer, the wind blows with a high degree of constancy from some south-westerly direction to the accompaniment of cloudy conditions and frequent rain over much of the region. In the other half-year there is a period of several months when the general wind flow is from some north-easterly direction, and the accompanying weather is fine. These contrasting seasons, characterised by the prevailing wind, are known as 'monsoons' from the Arabic word meaning "season". Because the south-west monsoon, for example, is the season of the south-west wind, the term "monsoon" has come to be used not only for the period during which the wind prevails, but also for the wind itself.

Between the two contrasting monsoons occur two periods of about two months each, roughly April and May, sometimes called the "hot weather" season, before the onset of the south-west monsoon, and roughly October and November, between the end of the south-west monsoon, and the beginning of the north-east monsoon.

On the west coast of India the whole period from the cessation of the south-west monsoon to its re-commencement is sometimes referred to as the "fine weather season".

On much of the west coast of Pakistan and India a very high proportion of the rainfall occurs during the south-west monsoon. In the south, however, the rainy season becomes more prolonged, and on the west coast of Ceylon there is appreciable rain in all months.

Although infrequent, tropical revolving storms, otherwise known as "cyclonic storms" are a serious hazard. Over the whole area between one and two such storms occur each year, on the average, although in some years there have been as many as three, and in other years, none.

Pressure.—*Figures 1 and 2* show the distribution of mean monthly atmospheric pressure at sea level for the months of January and July respectively.

In January the region is under the influence of high pressure, centred over Mongolia, and the winds are mainly north-easterly or northerly (the north-east monsoon). In July pressure is low over north-west India, and south-westerly winds (the south-west monsoon) prevail. In the extreme south, towards the equator, there is little seasonal variation of pressure. In the north, however, there is a large difference in the average pressure between the two seasons. Near Karāchi the mean pressure in January is about 18 mb. higher than in July, whereas at Colombo the corresponding difference is only 2 mb. Moreover, in January, the pressure in the north is higher than that in the south, while in July, the opposite is true, so that there is a reversal in pressure gradient over the area, between the two seasons. This is in accord with the corresponding reversal in the predominating wind direction from north-easterly in January, to south-westerly in July.

In February, the average monthly pressure is similar to that in January, but with values 1 to 2 mb. lower in most places.

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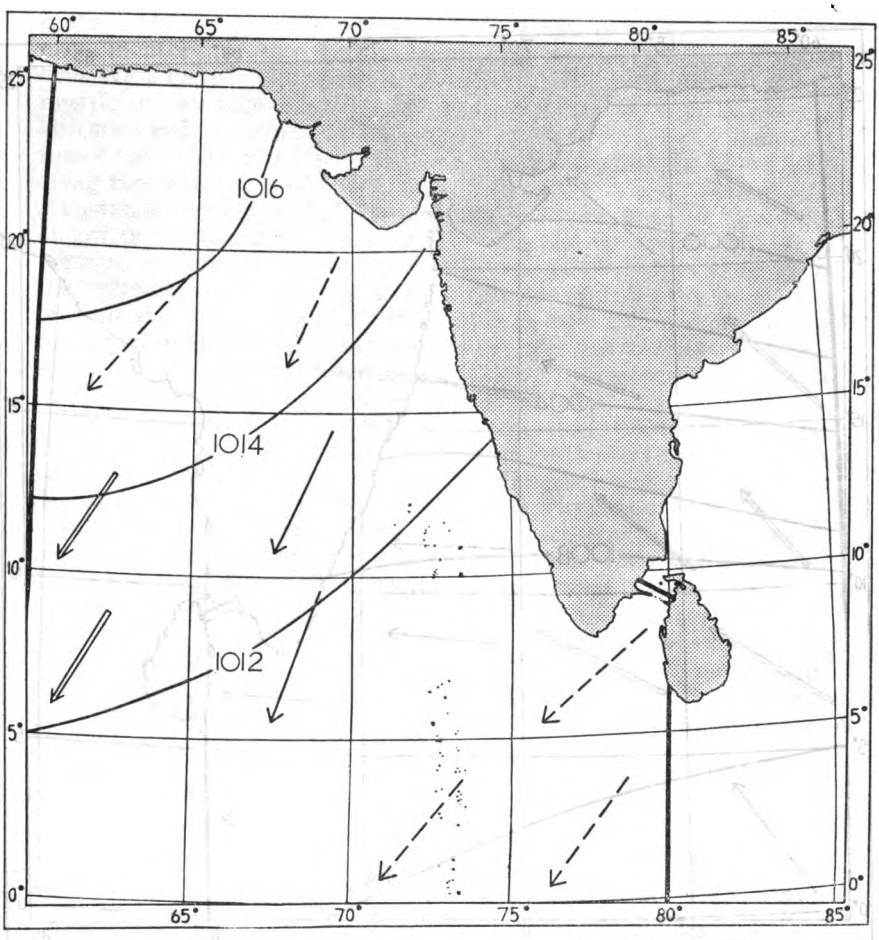

Fig. 1.

January

Mean sea level pressure distribution (in mb.) and predominant winds.

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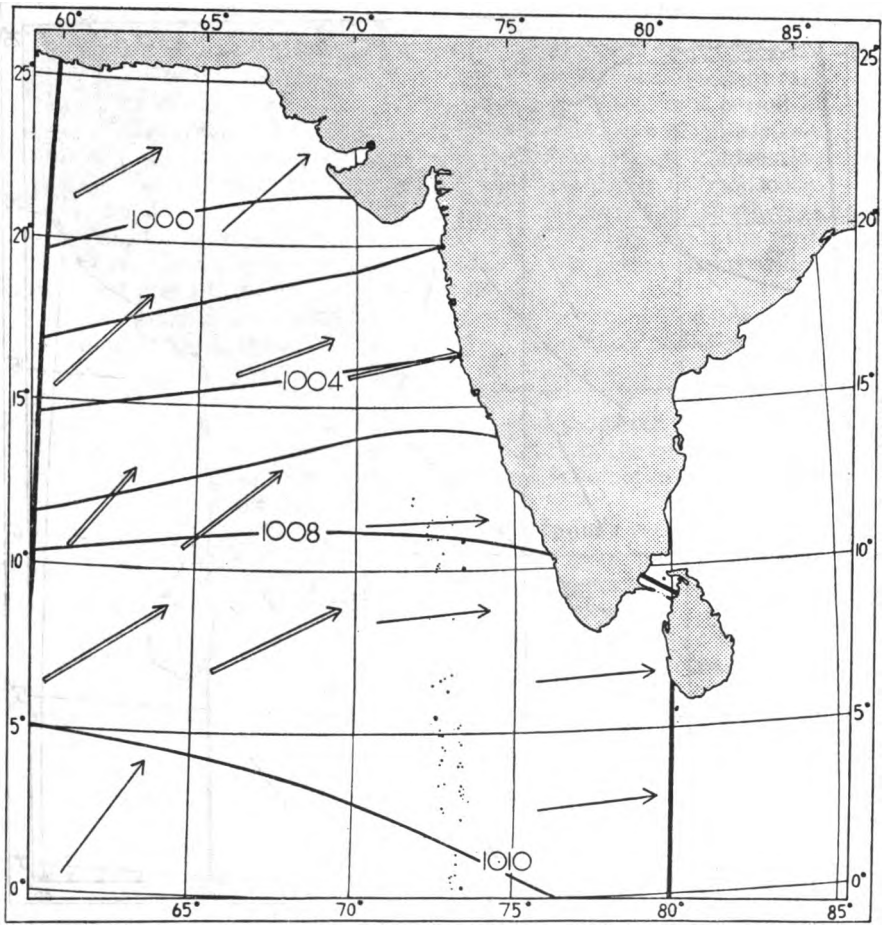

Fig. 2.

July

Mean sea level pressure distribution (in mb.) and predominant winds.

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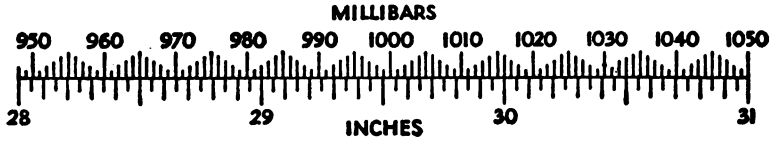
In March, the combination of a considerable fall in mean pressure in the north of India, with a continued slight fall in the south, produces a radical change in the distribution pattern, and in this month a shallow trough extends from north to south over the continent. The continuation of a greater fall of pressure in the north of India than in the south, leads in April to the formation of a centre of low pressure over north-east India.

In the ensuing months this low pressure centre deepens while the centre of lowest pressure retreats north-westwards, until in July, the mean monthly pressure is at its lowest, below 996 mb., and is centred over West Pakistan in about latitude 29° N., longitude 70° E. In this month the average pressure increases considerably with decreasing latitude, and is highest towards the equator. The general east-west run of the isobars is distorted by a ridge extending northwards roughly along the west coast of India. After July, the average pressure over Pakistan and northern India rises again, and in September, the centre of low pressure moves eastwards. By October, the continued rise of pressure in the north of the continent, with little change occurring in the extreme south, leads to a slack pressure distribution. A further pressure rise in the north in November leads to a return to the winter conditions of high pressure to the north of India and low pressure to the south. In the months November to February, inclusive, a trough extends northwards along the west coast of India.

The foregoing remarks refer to average monthly values of pressure. On individual occasions there will be large departures from the mean values for a given location, dependent on the particular movement and degree of development of depressions and anticyclones.

In addition to irregular changes due to depressions, etc., there is regular diurnal variation with maxima at about 1000 and 2200 and minima at about 0400 and 1600 local time, the range of variation on the Indian coast generally being about 4 mb. from December to March and 2 to 3 mb. from June to October. If the barometer reads as much as 3 mb. below normal for the time of day and for the month in question, this should be regarded as a warning that a tropical revolving storm ("cyclonic storm") may be forming or approaching the ship. (*See* page xxxix.)

The accompanying diagram shows the equivalent of millibars in inches and vice versa.



Depressions and Tropical Cyclones, Fronts.—Two main types of depression affect the area; they are tropical depressions and non-tropical depressions. The former move initially from the east and are sometimes called "eastern depressions", while the latter, in higher latitudes, move from the west, are sometimes called "western depressions" and have the same general character as the depressions of temperate latitudes. Of the tropical depressions, some are intense and develop a violent cyclonic circulation of winds and are of the same character as the "hurricanes" of the West Indies or the "Typhoons" of the China Seas, while others are less intense. While any criterion of differentiation

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between intense and less intense circulations must be arbitrary, it will be convenient to conform here to the usage of the Indian Meteorological Department. Thus the term "depression" will be used both for "western depressions" and for any eastern cyclonic circulation in which the wind does not reach Beaufort force 8, and the term "cyclonic storm" for any tropical cyclonic circulation wherein the winds reach or exceed force 8. The term "severe storm" is reserved for circulations in which force 10 is reached. A general description of the characteristics of non-tropical or "western depressions" is given in Article 1 on page xxxii. Tropical Revolving Storms, of which the "cyclonic storms" of the present region are an example, are described in Article 2 on page xxxix.

Over the area northward of about latitude 10° N. there are two periods in the year when the frequency of "cyclonic storms" reaches a maximum; the first period extends from late May to the first half of June, i.e. about the onset of the south-west monsoon, and the second from late October through the first three weeks of November, i.e. about the onset of the north-east monsoon. *Figures 3 and 4* show some actual tracks of "cyclonic storms" in the months June and November, respectively. It will be seen that, in June, the storms originate in the Arabian sea and initially move, for the most part, towards directions between north and north-west. Some of them curve more towards the west in their later stages, while others curve towards the north and may cross the Indian or West Pakistan coast heading in directions between north and north-east. Of the "cyclonic storms" that occur in the October to November period, the majority originate in the Bay of Bengal, and move westward or north-westward over, or to the south of, southern India, to the Arabian sea. Some continue to move towards the west or north-west, while others re-curve towards the north-east. Between late November and early January "cyclonic storms" become rare, and from early January, there follows a period of nearly three months without storms. There is a renewed likelihood of "cyclonic storms" in the later part of April, and though only four were reported in this month during a 69 year period, all four were "severe storms". In May storms become more frequent (12 in 69 years) and they reach a secondary maximum (17 in 69 years) in June, thereafter declining rapidly to practically nil in August, before increasing again to the November maximum.

The following table gives the total number of "cyclonic storms" reported in the Arabian sea between 1881 and 1949, together with the number that were "severe", i.e. those in which the wind reached force 10:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Total	3	0	0	4	12	17	4	1	4	17	21	4	87
Severe	0	0	0	4	10	12	0	0	0	6	14	1	47

While the average frequency of "cyclonic storms" in the Arabian sea is rather more than one per year, there have been years in which two or three have occurred, and also periods of one or two years without one.

A very destructive feature of "cyclonic storms" on the coasts of India and Pakistan is the storm wave which sometimes accompanies them. This is caused by the piling up of the water in the inner storm area. This storm wave advances with the storm and may cause widespread flooding and great loss of life in thickly populated areas.

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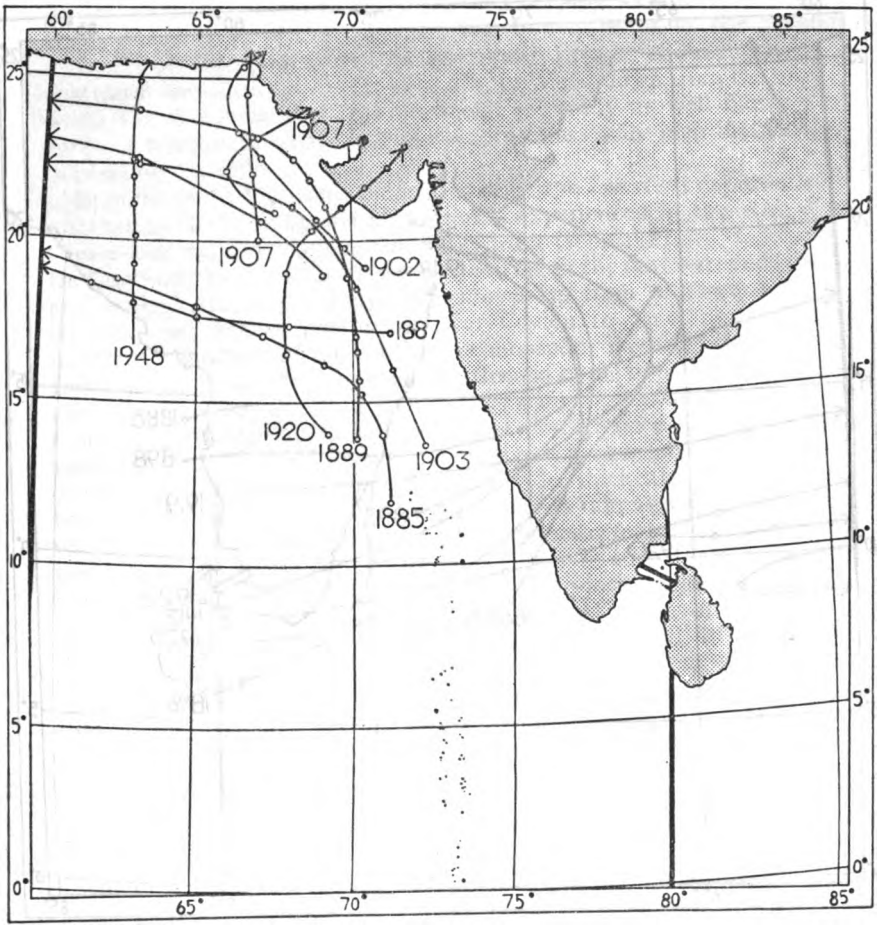

Fig. 3.
June
Tracks of Cyclonic storms.

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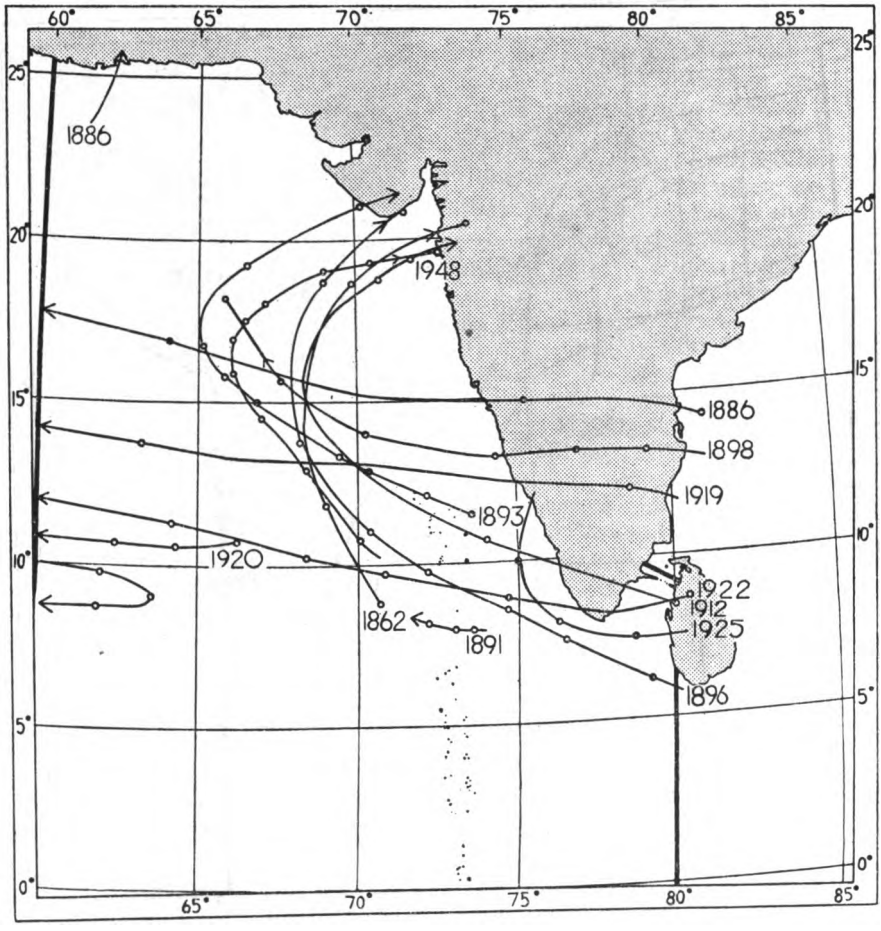

Fig. 4.
November.
Tracks of Cyclonic storms.

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In the winter and spring the northern parts of the area may be affected from time to time by "western depressions" moving typically eastward or north-eastward to West Pakistan. From November to April about four such depressions occur each month on the average, and may give rise to gales and squally weather in the northern parts of the area. Gales associated with such a depression caused damage at Karāchi in November 1928.

Western depressions are frequently accompanied by fronts, whose general character is described in Article 1 on page xxxiii. Accordingly, the northern parts of the area are liable to be affected by the passage of fronts of which the most typical are warm fronts advancing north-eastward over the area, and cold fronts spreading down from the north-west. The fronts in this region are not generally as well marked as those of temperate lattitudes, and become less easily identifiable with decreasing latitude.

In addition to the fronts associated with the "western depressions", another kind of frontal manifestation is experienced in the area. The "Inter-tropical Convergence Zone" or "Inter-tropical Front" represents the boundary between air masses originating in the northern and southern hemispheres, respectively. This moves up from southward of the equator, and passes northward over Ceylon in May, marking the northern boundary of the south-west monsoon. Passing over most of India during June, by July it lies northward of all the area. It returns, moving southward over much of India during September, and reaches Colombo in October. The Inter-tropical Convergence Zone (ITCZ) is very variable in its character. When active it is characterized by a belt of cloud which may be some 300 miles wide, thickening and lowering towards the centre of the belt, where there is rain and poor visibility, with occasional heavy squalls and thunderstorms. The progress of the ITCZ is often not continuous, but rather in surges, after which it may temporarily retreat or disperse, to re-form again. A feature of the ITCZ is that most "cyclonic storms" form on or near it when it is situated between about latitudes 5° and 15° from the equator.

Winds over 20 miles from the coast.—In the region covered by this volume, the south-west monsoon affects much of the area from about June to August and the wind then blows from the south-westerly quarter with a high degree of constancy. In the north-east monsoon, which affects most parts from about December to February or March, the wind is not so constant. The predominant winds in January and July, at the height of the north-east and south-west monsoons, respectively, are shown on *Figures 1 and 2*. The arrows show the direction of the predominant wind, if its constancy is at least 51 per cent, according to the following scheme:—

- - - → 51—60% ——→ 61—80% ⟹ 81—100%

Predominance is calculated for that quadrant (90°), not necessarily bounded by the four cardinal points, which contains the greatest number of wind observations. Only winds of force 3 or more are taken into account in estimating predominance. The arrow shows the direction bisecting the quadrant, and the constancy is defined as the percentage relation between the number of winds from that quadrant of force 3—12, and the total number of winds observed from all directions (including forces 0—2).

South-west monsoon.—Figures 5 and 6 give the normal dates of the onset and withdrawal, respectively, of the south-west monsoon.

Between March and May the predominant winds over the sea between

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about latitudes 5° N. and 20° N. change gradually from between north-east and north-west to between north-west and west. In June, with the onset of the south-west monsoon, they become between south-west and west and increase in strength, the increase being greatest in the region between about latitudes 10° N. and 20° N. By July, the latter region has become the windiest part of the area covered by this volume, the strength of the wind averaging about Beaufort force 5, and reaching force 7 or more on about four days in this month.

Around the Maldive islands, southward of about latitude 5° N. however, 90 per cent of all winds are light.

From June to August, northward of about latitude 5° N. three-quarters of all winds are from between south-west and west, the average strength being Beaufort force 4 to 5; between latitudes 10° N. and 20° N. it reaches force 7 or more on two to four days per month, and, farther northward, on one or two days per month. Southward of about latitude 5° N. the most frequent wind directions are between west and south, but near the equator, about half of all the winds are from between south-east and south-west. Brief squalls of force 8 or more are not uncommon in these three months, even in the extreme south.

After August a reverse series of changes in the predominant wind direction, accompanied by a decrease in strength, leads back to the north-east monsoon. A period of about two months, roughly October and November, when winds are mainly light, intervenes before the commencement of the north-east monsoon.

North-east monsoon.—The north-east monsoon normally begins earlier in the north of the region, where it is blowing fairly regularly by mid-November, than in the south, where it is not established until December. It continues until about March, during which month it becomes unsteady in the south.

The direction of the wind during the north-east monsoon is not so constant as in the south-west monsoon.

During the months in which the north-east monsoon is fully developed, about two-thirds of all winds blow in the directions indicated in the following areas:—

Westward of Ceylon between the equator and latitude 10° N.—Between north and east-north-east.

Between latitudes 10° and 20° N.—Eastward of longitude 70° E. between north-west and north-east. Westward of longitude 70° E. between north and east-north-east.

Northward of latitude 20° N.—Between west-north-west and east-north-east, through north.

On the termination of the north-east monsoon, about two months, roughly April and May, intervene before the onset of the south-west monsoon.

Over most of the region covered by this volume, the wind during the north-east monsoon is mainly light or moderate, and very rarely reaches Beaufort force 7. In the extreme north, however, "western depressions" (*see* page 31) may at times cause strong to gale force winds.

Over the ocean between Ceylon and longitude 75° E. winds of force 5 and 6 are frequent when the monsoons are at their height and force 7 is occasionally reported.

In the region southward of the equator, which includes the southern-most Maldives, the winds are more variable than farther north, especially at the height of the monsoons. Also, the direction of the

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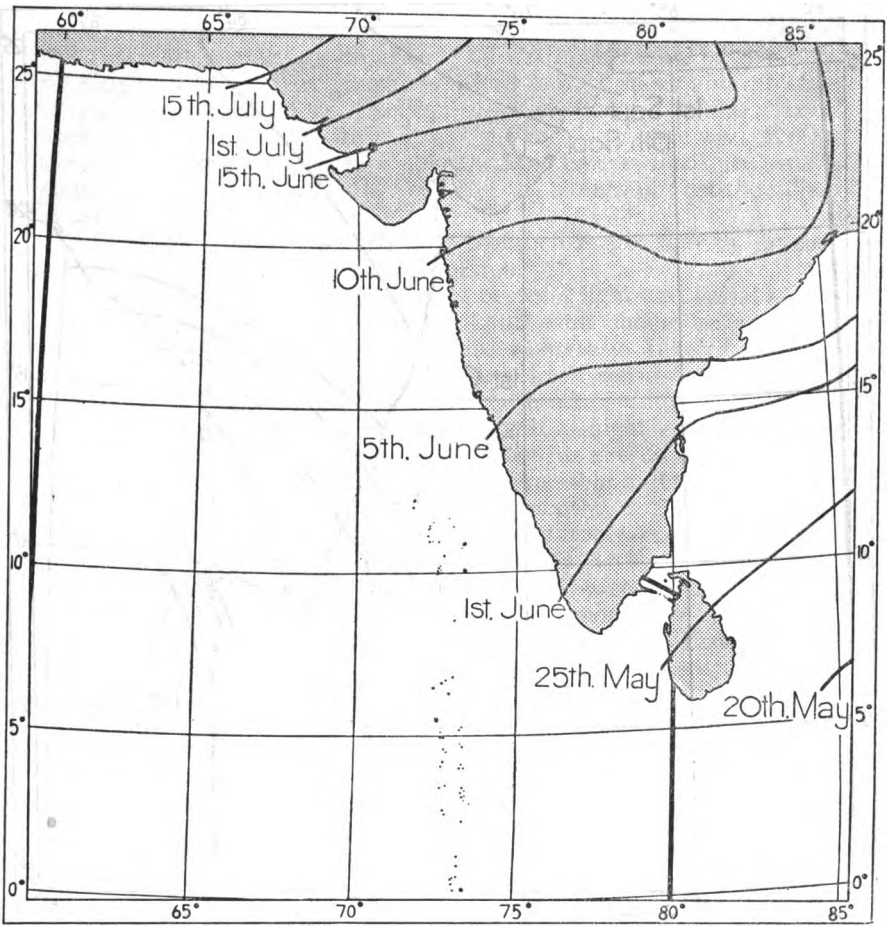

Fig. 5.

Normal dates of onset of South-west monsoon.

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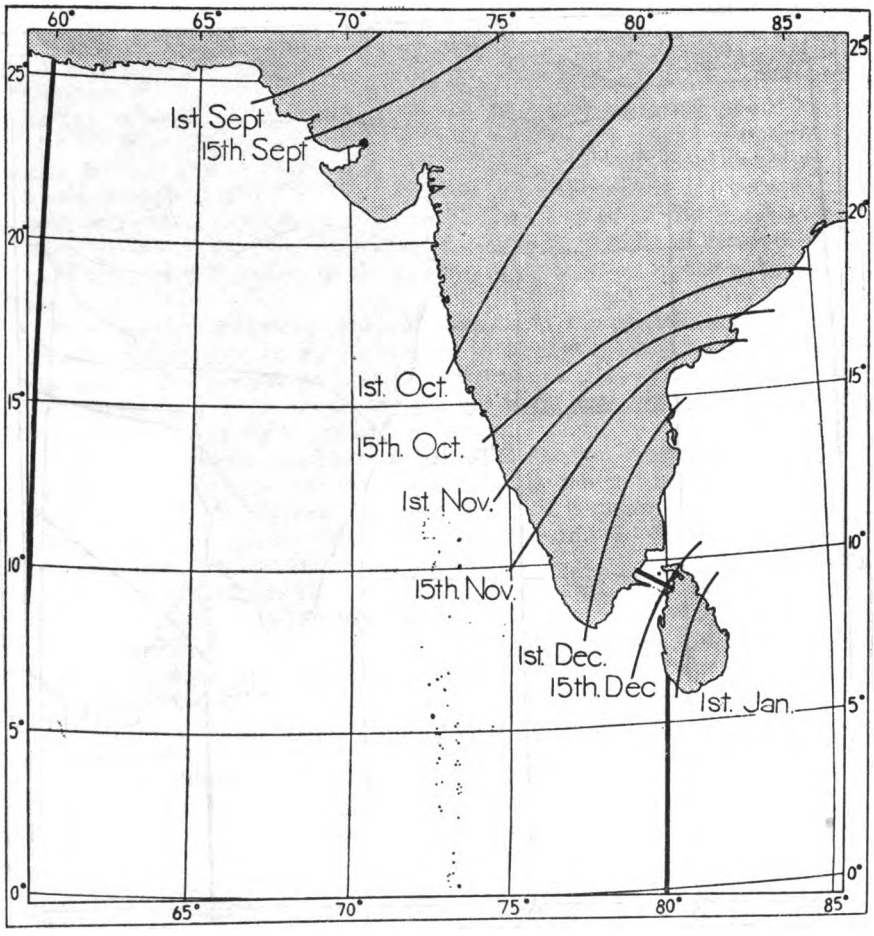

Fig. 6.

Normal dates of withdrawal of South-west monsoon.

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monsoons, which is fairly constant over a wide area northward of the equator, changes on passing over the equator, so that in the north-east monsoon, when the winds northward of the equator are from some north-easterly direction, those southward of it are mainly northerly. Similarly, in the south-west monsoon, the winds southward of the equator are mainly southerly. Thus in both seasons, as a vessel passes southward over the equator, there is a tendency for winds to back.

Winds within 20 miles of the coast.—The general character of the monsoon winds and their times of onset on the different parts of the coast are mainly as described for the open ocean in the same latitude, but local effects cause variations in both speed and direction of the coastal winds, as described in the standard article "Local Modifications of the Weather near the Coast" on page xlv. Except during the south-west monsoon, land and sea breeze effects are usually well developed near the coast. The following paragraphs list the salient peculiarities of the coastal winds.

Gulf of Mannar.—The north-east monsoon is steadiest in January and has weakened considerably by March.

Towards the end of April the wind becomes light and variable, and squally showers are common. The south-west monsoon is usually established sometime in May and gains strength in June.

From July to the end of September fresh south-westerly winds prevail, with mainly fair weather at the head of the gulf. The wind usually moderates near the head of the gulf at night and in the early morning, and freshens again in the afternoon, as a result of land and sea breeze effects. In October the wind is more variable, and there are heavy squalls with rain in the latter part of the month.

In November, the wind is mainly light and from some point between west-north-west and north-east. The weather is very unsettled with frequent heavy squalls and rain, the north-east monsoon usually becoming established by about the end of the month.

West coast of India, southward of latitude 16° N.—Land and sea breezes are experienced at most times of the year except during the south-west monsoon, when they are largely suppressed. During the north-east monsoon, the land breeze is well developed, especially in December and January, and, in places opposite gaps in the mountains, land winds may blow for more than a day without any intervening sea breeze. An example of this occurs in latitude 10° 45′ N. abreast Pālghāt gap and to a smaller degree at Kārwār (*Lat. 14° 50′ N., Long. 74° 06′ E.*). On the coast around Enseada da Agoada (*Lat. 15° 30′ N., Long. 73° 46′ E.*) in February and March the wind sometimes blows strongly from the north-east for periods varying from three to seven days, moderating somewhat at night. The land breezes decrease in strength and duration during March. Southward of Pālghāt gap the south-west monsoon usually sets in in late May or early June. It often begins with a gale from south-east, veering through south to south-west; at other times it begins with squalls from about south-west.

During the south-west monsoon the wind, which at sea is mainly westerly to south-westerly, is diverted by the Ghát mountains and blows mainly from west-north-west or north-west on the coast; it brings much rain and at times severe squalls, especially in the early part of the season. In September, the weather moderates, and towards the end of the month, or in October, strong easterly or southerly squalls (*see* "Elephantas" below) and thunderstorms indicate the approaching end of the monsoon.

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West coast of India, between latitudes 16° N. and 20° N.—The south-west monsoon generally sets in early in June, being preceded in April and May by a gradual backing of the prevailing wind and a progressive failure of the land breeze, by increasing cloud, showers and lightning, and sometimes by strong winds or gales from the south-west. When established this monsoon brings heavy clouds and much rain, and severe squalls at times, but some short intervals of fine weather are usual.

In August the monsoon generally begins to weaken, and normally finishes in September, being succeeded in October and early November by a period of light variable winds with occasional squalls and showers, after which the northerly winds of the north-east monsoon become established.

On all the west coast between Bombay and Cape Comorin, strong southerly or easterly squalls, which are sometimes called "Elephantas", commonly occur in late September or in October and are considered to herald the end of the south-west monsoon.

Coasts of India and West Pakistan, northward of latitude 20° N.—The south-west monsoon normally sets in in June, to an accompaniment of mainly overcast skies, occasional showers and strong winds. As on the coast southward of latitude 20° N. it is preceded by a month or two of progressive failure of the land breeze and strengthening of the sea breeze so that finally there is usually a wind off the sea by night as well as by day from about April onwards, being strongest in the afternoons. The south-west monsoon weakens rapidly in September, and is soon replaced by the north-east monsoon.

At Karāchi, the comparative constancy of the wind during the south-west monsoon and the alternation of land and sea breezes at other times of the year is demonstrated by the following table, which gives the average direction and speed of the wind at 4-hourly intervals as recorded between 1873 and 1894.

Time	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					degrees from North							
0000	331	280	259	251	248	239	244	248	250	262	298	9
0400	7	319	269	257	251	246	248	253	257	272	336	11
0800	26	356	274	258	251	249	252	254	259	282	10	24
1200	49	235	243	240	241	239	246	248	248	240	204	65
1600	228	238	240	238	238	235	239	241	243	237	231	214
2000	275	256	247	240	241	235	240	240	242	245	253	288
					knots							
0000	6·1	6·7	9·5	9·5	11·6	13·9	14·0	12·5	9·3	5·7	4·8	5·6
0400	6·3	6·4	8·2	9·1	11·2	13·6	13·8	12·8	9·3	5·5	4·6	6·0
0800	6·3	6·4	7·2	8·3	11·4	13·1	13·6	12·3	9·2	5·6	4·9	6·3
1200	7·1	7·9	10·2	11·9	14·2	14·9	14·7	13·8	11·9	8·6	5·7	6·9
1600	7·7	10·3	13·2	13·7	15·1	16·1	15·6	14·2	11·6	10·4	8·2	7·6
2000	6·9	8·5	11·3	11·2	12·8	14·7	14·2	12·8	9·5	7·4	6·2	6·3

On the average, 6 to 7 squalls occur at Karāchi during the year. They are most frequent in May, June and July and are usually accompanied by thunderstorms or dust storms, or both. Wind speeds exceeding 40 knots have been recorded at all seasons. From November to March the squalls generally come from a direction between north and west, and during the rest of the year from between north and east. The change of wind direction in the squalls is usually a veer.

Gales.—Gales are most frequent in July, at the height of the south-west monsoon. *Figure 7* shows the frequency distribution of gales

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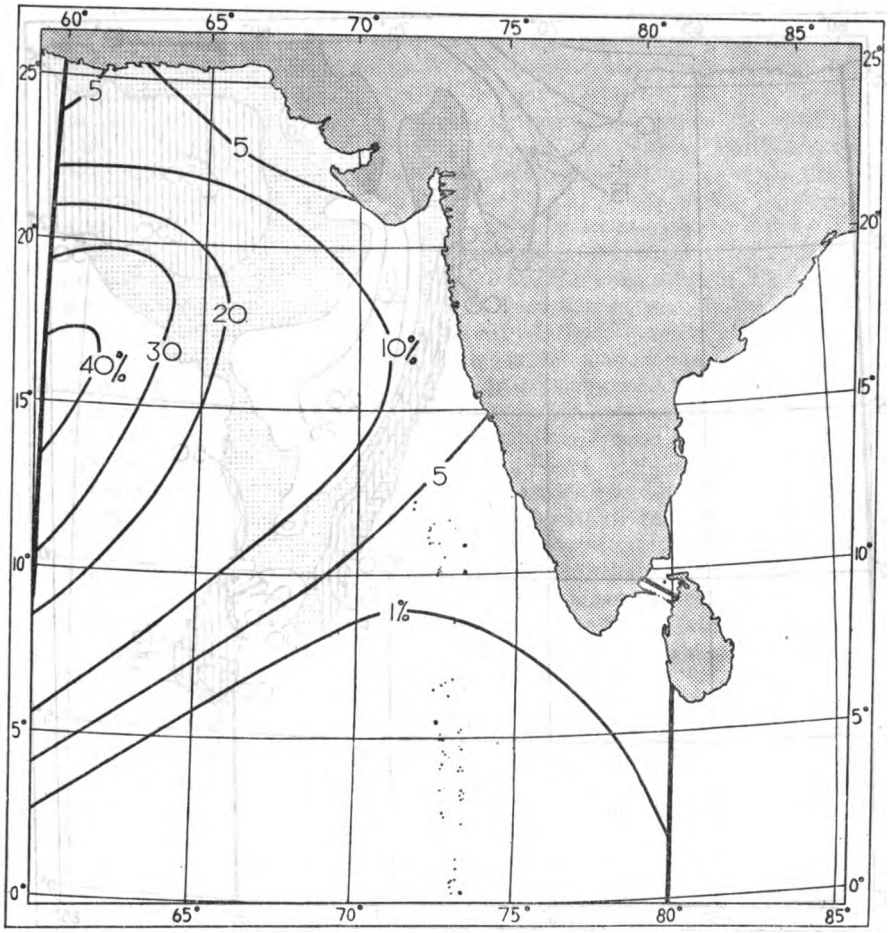

Fig. 7.
July
Gale frequency distribution (Force 7 and above).

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Fig. 8.
Mean annual rainfall (in inches).

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(force 7 and above) for this month. They are least frequent around the Maldive islands and near the equator and increase to a maximum frequency of over 40 per cent of observations over the ocean in the west of the present region, in the proximity of latitude 15° N., longitude 60° E. Off the coast, in this month, the gale frequency reaches 5 to 10 per cent from about Goa to Veraval on Kāthiāwār peninsula, and falls below 5 per cent both southwards and northwards along the coast. In August, gales are fewer, but with the same general distribution. The maximum frequency in the west falls to 30 per cent, and off the West Pakistan coast there is less than one per cent. In September there is a large reduction in the number of gales. The frequency over most of the area is between one and 5 per cent, but is less than one per cent off the coast of north-west India and West Pakistan and around the Maldive islands. In October and November the gale frequency is less than one per cent over the whole area. In December and January, there is a slight increase to between one and 5 per cent locally in the south. In March and April the frequency falls again to less than one per cent over the whole area. May shows an increase to between one and 5 per cent in the area around the Maldive islands and over the ocean in the far south-west, the rest of the region having less than one per cent. In June, there is a big increase. All the area westward of about longitude 75° E. and northward of about latitude 3° N. has more than one per cent in this month, and the frequency increases westwards to over 30 per cent in the proximity of latitude 11° N., longitude 58° E., the general pattern of distribution being similar to that indicated in *Figure 7* for July, when the gales are most frequent.

Cloud.—The average cloud amount varies considerably according to the monsoons. On and near the west coasts of India and Pakistan it is most cloudy at the height of the south-west monsoon, i.e. in July, when the average amount is about 6 oktas (eighths). At this time there is a decrease over the open ocean, towards the south-west and there is least cloud, less than 4 oktas, in the region around latitude 10° N., longitude 60° E. Throughout the south-west monsoon there are prolonged overcast periods on the coast.

There is least cloud on these coasts in February when the average cloud amount is less than 2 oktas from about latitude 14° N. northwards. Farther southward the amount is about 3 oktas. At this season there is an increase over the open ocean going from the Indian coast towards the south-west. Over the sea area as a whole, March is the month of least cloud, with less than 2 oktas over most of the area northward of latitude 15° N. There is at this time slightly more cloud on the middle parts of the Indian coast and a maximum, over 4 oktas, to the south-east of the Maldive islands.

In May the cloud increases, and is nowhere less than 2 oktas, being more than 4 oktas over the south-east part of the sea area, and on the coasts of Ceylon and India as far northward as about latitude 12° N. There is a further large increase over the whole area in June, leading to the July maximum.

The approach of the south-west monsoon is heralded on the west coast of India from Bombay southwards, by the daily formation of large clouds over the mountains. These clouds move westwards against the prevailing winds near the ground, and are accompanied by vivid displays of lightning. They disappear after sunset. This continues for a week or more, until the first onset of the monsoon, which seldom lasts more than a night and part of a day. As the monsoon fairly sets in, the sky becomes cloudy or overcast, with only short intervals of broken skies.

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September brings a decrease in average cloud to less than 4 oktas northward of about latitude 20° N. and the cloudiest region, eastward and southward of the Maldives, has about 5 oktas. In the subsequent months there is a gradual decrease to the February minimum.

On the north-west coast of India and Pakistan there is rather more seasonal variation (6 oktas in July and about 2 oktas in February) than on the southern-most coast of India and on the coast of Ceylon. On the latter the average is about 6 oktas in June when most cloudy, and between 3 and 4 oktas in February and March, when least so.

On the west coast of Ceylon, and at Trivandrum (*Lat. 8° 29′ N., Long. 76° 57′ E.*) there is, during the period of the north-east monsoon, a well-marked diurnal variation of cloud amount. The sky is often nearly or quite clear during the latter part of the night and in the early morning, with cloud increasing during the day to a maximum in the afternoon and evening.

On the west coasts of the Indian peninsula and Ceylon generally, during the south-west monsoon, there is little diurnal variation, but the cloudiest skies usually occur when the monsoon is blowing strongly.

Rainfall.—The mean annual rainfall on the coasts covered by this volume shown in *Figure 8*. It is high in most places southward of latitude 20° N. being between 60 and 130 inches (two and a half to five times that of south-east England). An exception is the north-west shore of the Gulf of Mannar, where the rainfall drops below 30 inches. Northward of latitude 20° N. the rainfall decreases rapidly and is less than 10 inches per annum on the coast of West Pakistan.

The wettest part of the coast lies between about latitudes 10° N. and 18° N. where most places report over 100 inches per annum. Mangalore (*Lat. 12° 52′ N., Long. 74° 50′ E.*) has 136 inches per annum. The mean rainfall falls off southward of about latitude 10° N. and Trivandrum (*Lat. 8° 29′ N., Long. 76° 57′ E.*) has an average of 69 inches per annum. The decrease continues to Cape Comorin and thence to the local minimum in the north-west of the Gulf of Mannar. On the west coast of Ceylon, rainfall increases rapidly southwards to a maximum just southward of Colombo, where there is 95 inches per annum. Minicoy in the Laccadive islands has an annual total of 63 inches.

On the west coast of India, there is a very strongly marked seasonal distribution of rainfall, nearly all of it coinciding with the south-west monsoon. Thus, at Mangalore, out of a total of 136 inches, 102 inches falls in the three months June to August, while January to March each have less than 0.4 inches. At Karāchi, the former three months provide about three-quarters of the rainfall, but the remaining quarter is more evenly spread over the winter months, due mainly to showers associated with "western depressions".

Southward of about latitude 10° N. the seasonal distribution is complicated by the appearance of a secondary maximum in the latter part of the year. Thus at Trivandrum the peak month is June, rather than July; August and September show a marked decrease from July, but the rainfall in October is second only to that of June, and the amount in November is considerable. This double maximum is found also in Ceylon, where at Colombo, the peak months are May and October. Here there is considerable rain in all months, the driest month, February, having 3 inches. In the north and north-west of the Gulf of Mannar, sheltered from the south-west monsoon, November is the wettest month. Pamban (*Lat. 9° 17′ N., Long. 79° 13′ E.*) has 12

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inches in November and less than one inch from June to August.

At Minicoy the maximum rainfall is in June (11.6 inches) but there is only a gradual decrease to about 3 inches in December, and the driest months, February and March, each have about one inch.

The variation from year to year is greatest where the rainfall is least, namely on the coast of West Pakistan. Here, over a 90 year period, the rainfall in the driest year was only 6 per cent of the average, while the wettest year had 361 per cent of the average. In contrast, Kārwār (*Lat. 14° 50′ N., Long. 74° 06′ E.*), where the annual average is 118 inches, over a similar period reported annual values all lying within 61 per cent to 163 per cent of the average.

In the south-west monsoon, when rainfall is heavy over most of the west coast of India, it decreases progressively towards the south-west, with increasing distance from the coast. By comparison, in the north-east monsoon, when rain amounts on the coast are small, there is a gradual increase over the open sea with increasing distance from the coast.

The average number of days per month with appreciable rain (0.1 inches or more) in the wettest month in the Maldive islands is 17, in Colombo 15 and at Pamban 13. It increases to 29 in the wettest region on the west coast of India, and falls to 7 at Dwárka, and to 3 at Karāchi.

The intensity of rain is very great at times on the west coast of India where falls of 6 inches in 24 hours are not infrequent. At Bombay 16 inches once fell in 24 hours in June, and 18 inches has been reported at Surat. At Karāchi 7 and 8 inches per day have fallen in June and September, respectively. 7 inches in a day has been reported at Minicoy.

Thunderstorms.—These are comparatively frequent, especially in the southern part of the region. The following table gives the average number of days with thunder during the period 1914–1923.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Karāchi	0·4	0·7	0·7	0·6	1·3	0·3	2·6	2·0	1·8	0·5	0·0	0·4	11
Bombay	0·0	0·0	0·2	0·7	1·7	4·7	2·0	0·2	4·8	2·8	0·3	0·0	17
Mormugão . . .	0·0	0·0	0·1	1·6	2·1	1·9	0·6	0·0	1·8	3·1	2·6	0·1	14
Mangalore . . .	0·7	0·0	0·6	4·4	6·9	5·2	1·8	0·3	1·5	6·9	5·5	0·7	35
Cochin	3·5	1·7	9·5	19·1	16·4	6·3	2·4	1·8	4·6	16.2	15·0	4·2	101
Trivandrum . . .	3·2	2·8	12·2	18·9	13.6	4·2	2·3	2·2	5·0	12·2	11·1	3·3	91
Mannar	0·7	0·7	3·6	16·4	8·7	1·9	3·2	4·7	5·3	8·8	6·2	1·6	67
Colombo	2·6	1·3	6·0	7·8	5.7	1·0	0·4	0·5	1·2	3·4	3·9	3·3	37

It will be observed that the highest frequencies are generally found in one or other of the two transitional periods between the monsoons.

In the Maldive islands, thunderstorms are not so frequent; they are more evenly distributed throughout the different months, but are rather more common between March and June than between September and December. The few thunderstorms that may be expected on the coasts of West Pakistan and Kāthiāwār peninsula nearly all occur between May and September.

Hail is very rarely observed on these coasts.

Fog and visibility over the open sea.—Fog over the open sea is practically unknown except for a few occasions, southward of about latitude 15° N. during the months August to October. Records of poor visibility (less than 5 miles) over the sea, are more frequent and reach a maximum (over 50 per cent of observations) in the extreme north-

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west of the area in July. *Figures 9 and 10* show the frequency distribution of poor visibility for the months January and July, respectively.

From April to July, visibility less than 5 miles is comparatively frequent (more than 20 per cent of observations) northward of about latitude 20° N. Much of the poor visibility is due to dust in the earlier months and to rain in the later months of this period. Off the coast of West Pakistan there is a strong seasonal variation of poor visibility from the maximum of about 50 per cent of occasions in July, to the minimum in the period November to January, when it falls to less than 2 per cent. Off the south coast of India there is much less seasonal variation, and southward of about latitude 15° N. the frequency is mainly between 10 and 20 per cent in the periods of greatest frequency from January to March and from June to August. In the period September to December, when it is least frequent, the frequency is still mainly in the range 5 to 10 per cent.

Fog and visibility on the coast.—On the coast, mist sometimes develops during sunrise after a calm and nearly cloudless night, but soon disperses after sunrise. This happens more often on the coasts of Kāthiāwār peninsula and West Pakistan, than elsewhere, while on the coasts of West Pakistan and the Gulf of Kutch, thick fog banks have been known to develop between October and February, drifting to seaward with the land winds and returning with the sea breezes, until dispersed by the heat of the day. Normally, however, the coast of West Pakistan is clearest in the early morning before the light alluvial sand is raised by the wind. During the day a haze frequently hangs over the land.

Between Bombay and Calicut (*Lat. 11° 15′ N., Long. 75° 46′ E.*), during the north-westerly winds between February and May, the air is generally hazy, especially in March and April. Haze is reported to be common on the coast around Cochin.

The Western Ghâts are generally obscured from April to October, but sometimes become visible for a short time after heavy rain. The same is true of Adam's peak in Ceylon.

At Bombay, from November to March, a great smoke haze frequently hangs over the land, obscuring everything from view. This happens most often shortly after sunrise, but also occasionally in the evening.

In the Gulf of Mannar during the south-west monsoon, thick haze frequently obscures the islands that fringe the coast near Pamban (*Lat. 9° 17′ N., Long. 79° 13′ E.*).

Air temperature.—Temperature is high throughout the year, over most of the region.

In the Maldive islands the monthly mean ranges from 81 to 83° F; at Colombo from 79° F. in December to 82° F. in May; at Trivandrum (*Lat. 8° 29′ N., Long. 76° 57′ E.*) from 77° F. in December, January and July, to 82° F. in April; at Mormugão (*Lat. 15° 25′ N., Long. 75° 47′ E.*) from 76° F. in January to 84° F. in May; at Bombay from 75° F. in January to 85° F. in May; at Dwárka (*Lat. 22° 14′ N., Long. 68° 58′ E.*) from 69° F. in January to 84° F. in June, and at Karāchi from 67° F. in January to 85° F. in June. These figures show that the mean temperature in the hottest month, which is generally just before the onset of the south-west monsoon, is nearly the same throughout the whole region but that there is a considerable difference between the southern and northern parts as regards the mean of the coolest month. Also the range of variation of temperature is far greater in West Pakistan than in the south. This is more noticeable when considering

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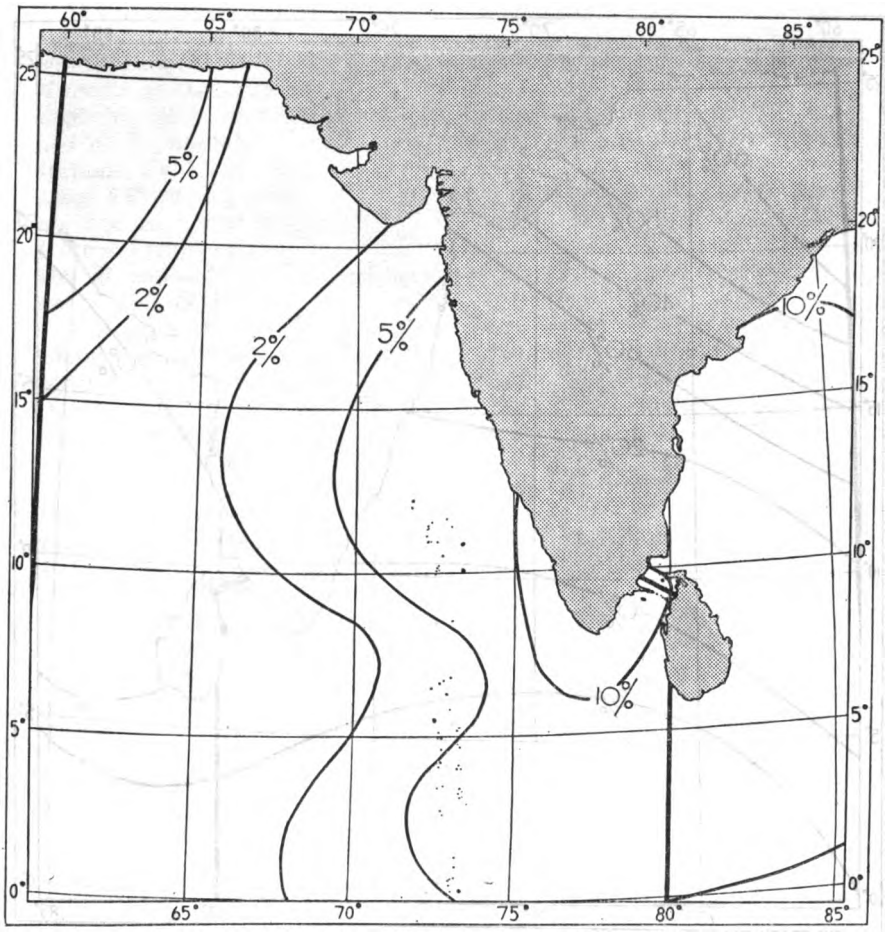

Fig. 9.
January
Frequency of poor visibility (under 5 miles).

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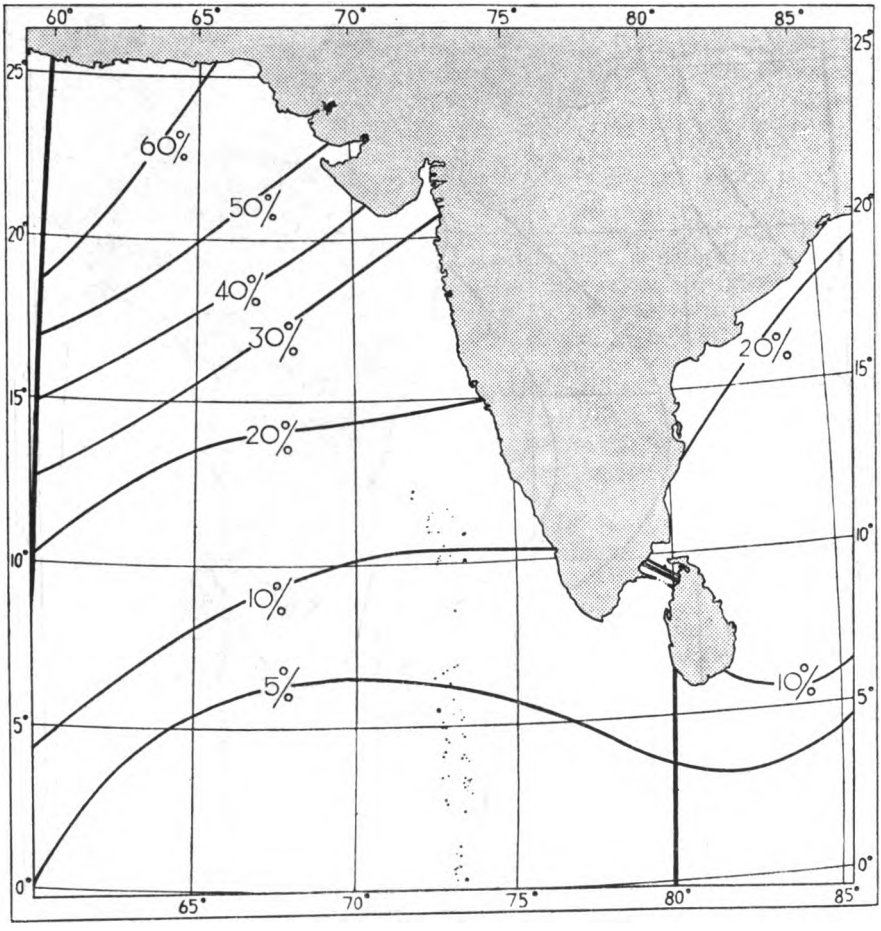

Fig. 10.
July
Frequency of poor visibility (under 5 miles).

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maximum and minimum temperatures. At Karāchi the monthly mean of day maximum temperature is highest in June when 90° F. and the monthly mean of day minimum temperature is lowest in January, when 57° F. This gives a range of 33° F. The corresponding range at Minicoy island, in the south, is only 15° F., between 89° F., the highest mean day maximum, which occurs in April and May, and the lowest mean day minimum, 74° F., which occurs in January and February.

At Trivandrum, in southern India, the highest monthly mean of day maximum temperature is the same as at Minicoy while the lowest monthly mean of day minimum temperature is 1° F. lower than at Minicoy, so that the range here (16° F.) is also less than half that at Karāchi. At Mormugão the corresponding temperatures are 89° F. and 70° F., but while the minimum occurs in January as at most other stations, the maximum is reached in May. At Surat (*Lat. 21° 12′ N., Long. 72° 49′ E.*) it becomes very hot in April in the afternoons, the average day maximum temperature being 99° F. in this month. Extreme temperatures measured at Karāchi over a 29 year period are 109° F. and 43° F. In the south, at Minicoy, the extremes recorded are 98° F. and 63° F.

The nights are very warm in all months in the Maldive and Laccadive islands, and on the coasts of Ceylon and India southward of about latitude 15° N. Northward of latitude 15° N. the nights become cooler in the winter months, but they are very warm in the months April to September, while in either May or June the average minimum temperature is not below 76° F.

Northward of about latitude 20° N. from December to February, there is substantial relief from the hot weather. At Karāchi the average temperature for this period is 68° F. The temperature occasionally falls to between 40° F. and 45° F. over most of this northern region and has been known to fall even lower, with slight ground frost inland.

In the south of the region, where there is relatively little seasonal or diurnal variation of temperature, so also there is little day to day variation. In the north, where there is more seasonal and diurnal variation, there are larger day to day changes. Some of the more sudden of these are due to the passage of fronts associated with "western depressions". Thus off the coast of West Pakistan, during the period November to April, there are liable to be relatively sudden falls of temperature of several degrees accompanied by a veer of wind, typically from about west to north-west, on the passage of a cold front.

Relative humidity.—In the Laccadive and Maldive islands relative humidity is moderately high at all times and seasons, being mainly between 70 and 80 per cent. The average values at Colombo cover the range 67–89 per cent and at Pamban they are mainly between 75 and 85 per cent. On the west coast of India there is a larger range from the damp conditions in early morning in the wet season to the drier conditions in the afternoon in the dry season. On the southern parts of the coast this range is from about 90 to 62 per cent, and it increases northwards along the coast, reaching a maximum at Karāchi, where at 0800 in August the average humidity is 90 per cent, whereas in January at 1700 it is as low as 44 per cent. As with other elements, the northern parts of the area are more liable to random variations of humidity than the south, where there is little day to day variation.

The diurnal variation of relative humidity is least during the south-west monsoon, at most stations, but the months in which there is greatest variation varies considerably from place to place.

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At Karāchi the humidity varies least during the south-west monsoon (July and August) and most in March and October.

The drop in temperature of several degrees after the burst of the south-west monsoon brings little or no relief, as the damp air and increase of cloud make the weather sultry and enervating.

Sea temperature.—*Figures 11 and 12* show the distribution of sea surface temperature for the months January and May, respectively, these being the months in which the lowest and highest mean sea temperatures are recorded. From December to March inclusive there is a large difference in temperature between south and north, and in February, the sea temperature is as low as 70° F. near the coast northward of Karāchi and exceeds 82° F. over a considerable area in the south.

From February onwards temperatures rise, rapidly in the north, but only slowly in the south, so that in May the sea temperature is above 84° F. in a considerable area between the equator and about latitude 15° N. and even the minimum temperature is about 81° F. near Karāchi.

The onset of the south-west monsoon in about June causes a drop in temperature in the south and, by July, the coastal waters have temperatures between about 80 and 82° F. Until November there remains only a small temperature gradient from north to south. After November temperatures begin to fall comparatively rapidly in the north, particularly off the coast of West Pakistan, and this continues, with little change in the south, until the January situation is reached (*Fig. 11*).

Throughout the year the mean air and sea temperatures are within 1 or 2 degrees of one another. From November to May the sea is this amount warmer than the air in places, while from June to November there are areas in the north where the sea is correspondingly colder.

Climatic tables.—The tables that follow give statistics for several land stations where weather reports have been made regularly. The figures given are averages, percentage frequencies, or extremes, as stated. It must be realised that these values refer to *the actual positions in which the weather has been observed*, and not necessarily to the open sea or to the approaches to ports in the vicinity. The tables for land stations should, therefore, be used with discretion, since all the elements are affected, some of them considerably, by local conditions. The following notes indicate ways in which conditions over the open sea may differ from those at the nearest recording station for which a table is published.

(i) Wind speed is nearly always greater over the sea than over the land, and there may be twice as many gales at sea as at a shore station, unless it is exceptionally well-exposed as, for example, on a headland or small low lying island. Wind direction is affected as explained under "Local Modifications of the Weather near the Coast" on page xlv.

(ii) Cloud amounts may differ considerably at the recording station from those a few miles out to sea.

(iii) The figures for precipitation are usually fairly applicable to coastal waters but become less applicable with increasing distance from the coast. Where there are high cliffs, or where a range of hills rises sharply behind the recording station, then with onshore winds, the station may record considerably more precipitation than would be experienced a few miles out to sea.

(iv) The figures for fog or poor visibility at land stations are liable to be most misleading as a guide to conditions at sea and in the

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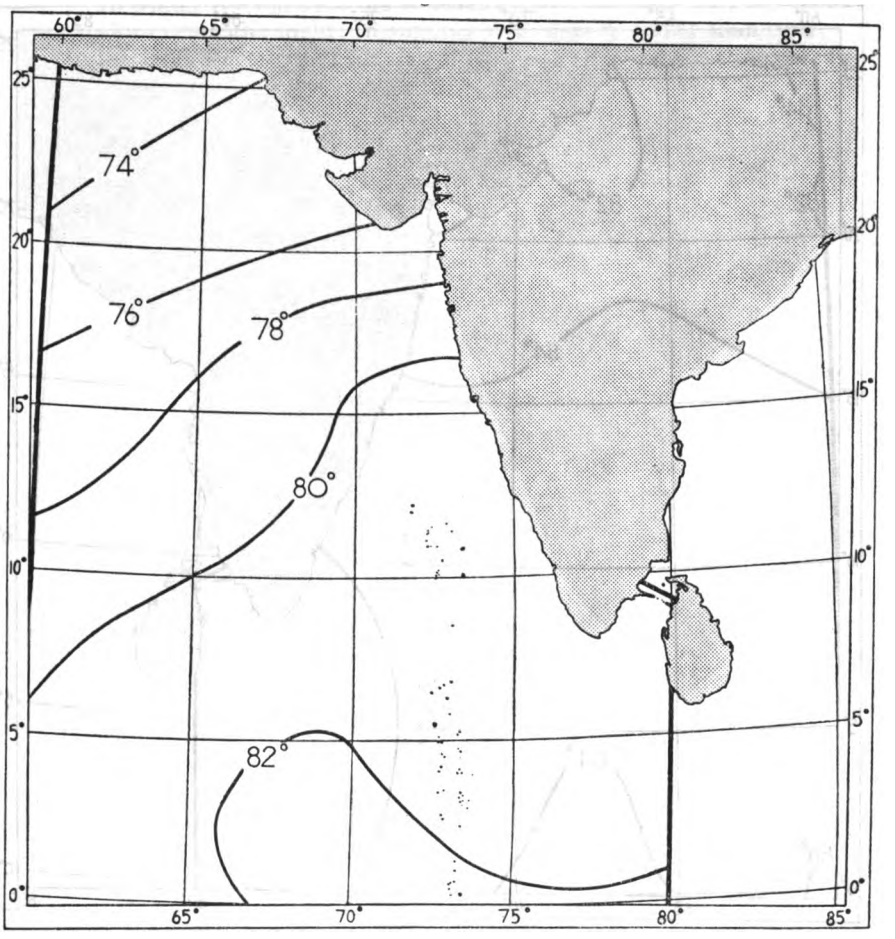

Fig. 11.
January
***Mean sea surface temperature* (°*F.*).**

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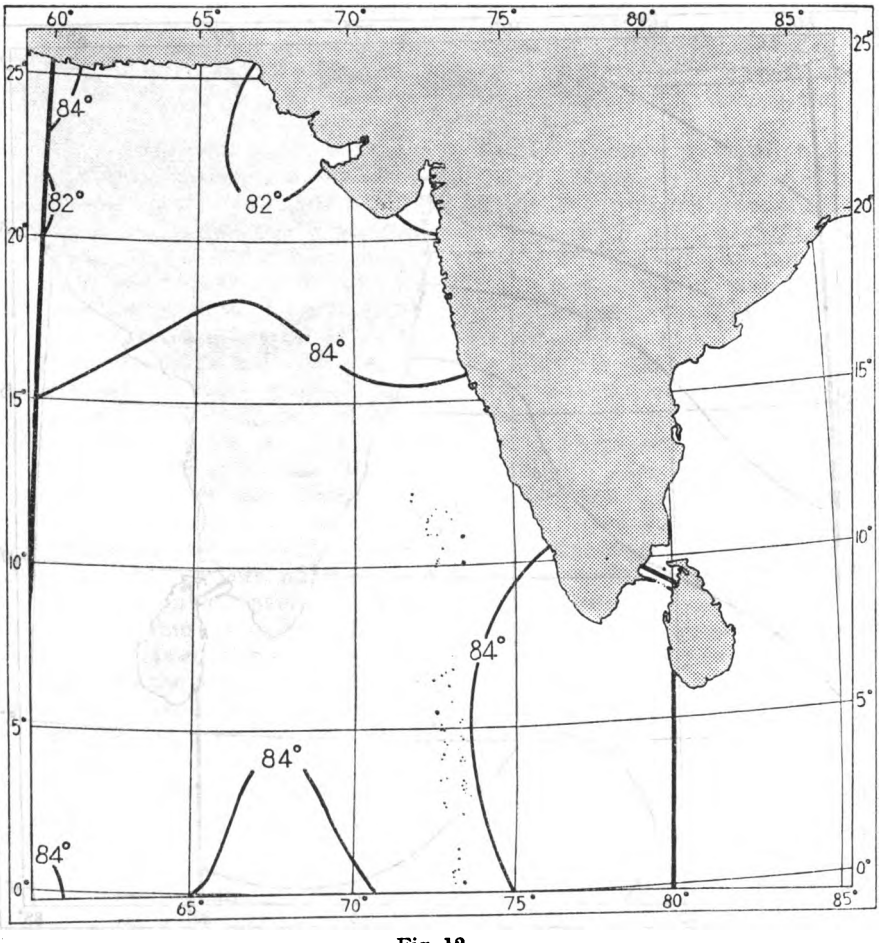

Fig. 12.
May
Mean sea surface temperature (°F.).

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approach to ports. Fog over the open sea is largely associated with mild winds blowing over relatively cold water, and is most common in summer. Fog inland, however, and near the heads of inlets, is frequently of the radiation or "frost smoke" types which occur most often in winter. When there is fog in a sheltered harbour or inlet, it is often clear at sea and vice versa.

(v) Temperatures over the sea are less variable than over the land. In winter the temperature is usually higher over the sea, especially during the night. In summer it is usually cooler than over the land especially in the day time.

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PLACE—MINICOY. LAT. 08° 18′ N., LONG. 73° 00′ E. HEIGHT ABOVE MEAN SEA LEVEL—48 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 26 YEARS' OBSERVATIONS, 1891 TO 1951.

Month	Pressure at M.S.L. Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity 0800	1700	Mean cloud amount 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0800: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	1700: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with	No. of days with
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1012	86	74	88	69	76	71	3·7	3·8	1·8	3	35	39	12	4	1	1	0	2	6	40	32	17	3	1	0	0	4	3	3	—	—	—
February	1012	86	74	88	70	75	71	4·0	4·2	1·1	2	46	32	7	2	1	0	1	5	6	53	20	6	5	1	0	1	13	1	3	—	—	—
March	1011	88	77	90	72	73	71	3·7	3·6	0·8	1	49	20	4	3	1	1	2	15	5	47	9	5	2	1	1	5	29	1	3	—	—	—
April	1010	89	79	92	74	72	71	4·3	4·6	1·9	3	34	9	5	2	1	4	7	31	7	22	2	1	1	1	1	17	51	4	3	—	—	—
May	1009	89	80	92	74	76	74	5·1	5·6	7·5	9	12	2	1	1	1	9	24	48	2	10	0	0	0	1	6	24	58	1	5	—	—	—
June	1009	86	78	89	74	81	79	6·7	7·1	11·6	17	2	0	0	0	1	27	53	16	1	1	0	0	0	1	6	70	22	0	9	—	—	—
July	1009	86	77	88	73	82	79	6·5	7·1	9·5	15	1	0	0	0	0	13	65	20	1	1	0	0	0	0	6	68	24	1	8	—	—	—
August	1010	85	77	87	73	81	78	6·3	6·8	7·7	12	5	0	0	0	0	7	47	41	0	1	0	0	0	0	1	53	45	0	7	—	—	—
September	1011	86	77	87	74	80	78	5·5	5·9	6·2	10	10	1	1	1	0	5	34	47	1	5	0	0	0	0	1	32	61	1	6	—	—	—
October	1011	86	76	88	72	78	76	4·9	5·3	5·6	9	11	6	2	3	4	10	32	30	2	7	3	3	3	3	5	27	43	6	5	—	—	—
November	1011	86	76	88	71	78	76	4·7	5·3	5·7	9	17	15	8	6	5	8	19	16	6	15	8	8	5	6	5	16	22	15	3	—	—	—
December	1012	86	75	88	70	76	72	3·8	4·3	3·5	5	27	33	10	7	4	1	2	5	11	22	24	15	5	5	2	4	13	10	3	—	—	—
Means	1011	86	77	94*	69**	77	75	4·9	5·3	—	—	21	13	4	2	2	7	24	23	4	18	8	5	2	2	3	26	32	4	4	—	—	—
Totals	—	—	—	—	—	—	—	—	—	62·9	94	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme values	—	—	—	98†	63††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	←	—	26	—	—	→	11	26	11	←	26	→	←	—	—	—	20	—	—	—	→	←	—	—	—	5	—	—	—	→	26	—	—	—

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Service.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

§Mean of 24 hours.

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PLACE—COLOMBO. LAT. 06° 54′ N. LONG. 79° 52′ E. HEIGHT ABOVE MEAN SEA LEVEL—19 FT.
CLIMATIC TABLE COMPILED FROM 7 TO 30 YEARS' OBSERVATIONS, 1908 TO 1955.

Month	Pressure at M.S.L.	Air temperature Mean				Relative humidity		Mean cloud amount		Rain		Wind direction 0930									Wind direction 1530									Mean wind speed in knots		No. of days with wind speed >	No. of days with visibility < 1,100 Yds.
												Percentage of observations from									Percentage of observations from												
	‡ Mean	Daily max.	Daily min.	Highest in each month	Lowest in each month	0800	1700	0800	1700	Average fall	No. of days with 0·1 in. or more	N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW	Calm	§		8.	
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																					
January	1012	86	72	90	67	87	68	4·4	4·9	4·0	5	18	61	5	3	1	1	1	4	6	21	17	0	1	1	7	13	39	1	4	—	†† 0	†† 0
February	1012	87	72	91	67	87	67	4·2	5·1	3·0	4	10	50	9	8	2	4	2	5	10	6	4	0	0	1	11	33	45	0	3	—	0	0
March	1011	88	74	91	70	87	69	3·3	4·8	4·7	7	7	28	8	11	6	12	7	7	14	2	2	0	1	1	25	45	25	0	3	—	0	0
April	1010	88	76	90	72	87	73	5·5	5·9	10·2	12	4	10	6	13	10	28	10	6	13	1	1	1	2	5	41	35	12	2	3	—	0	0
May	1009	87	79	89	72	86	77	6·2	6·3	15·0	15	1	3	2	8	7	57	15	3	4	1	1	1	2	6	65	20	3	1	4	—	0	0
June	1010	86	77	87	73	85	78	6·7	6·9	8·7	14	0	1	0	2	5	65	22	3	2	0	0	0	0	4	66	25	4	1	5	—	0	0
July	1010	85	77	87	73	84	77	6·5	6·8	5·8	9	0	0	0	1	3	60	28	5	3	0	0	0	0	4	58	32	5	1	4	—	0	0
August	1011	85	77	87	73	84	77	6·6	6·6	4·7	8	0	0	0	1	4	64	25	5	1	0	0	0	0	3	65	29	3	0	4	—	0	0
September	1011	85	77	87	73	84	76	6·3	6·7	6·2	10	0	0	1	3	4	63	23	4	2	0	0	0	1	4	63	29	3	0	4	—	0	0
October	1011	85	75	87	72	87	76	5·9	6·6	14·3	15	2	6	4	5	5	41	19	8	10	1	1	0	1	2	46	34	14	1	3	—	0	0
November	1011	85	73	88	68	89	75	5·1	6·5	12·3	14	11	27	8	9	4	10	8	10	13	10	4	1	1	3	20	28	31	2	3	—	0	0
December	1011	86	72	89	68	88	74	4·8	5·8	6·6	8	21	55	6	3	1	1	1	5	7	22	16	1	1	2	7	13	37	1	4	—	0	0
Means	1011	86	75	92*	65**	86	74	5·5	6·1	—	—	6	20	4	6	4	34	14	5	7	5	4	0	1	3	40	28	18	1	4	—	—	—
Totals	—	—	—	—	—	—	—	—	—	95·5	121	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme values	—	—	—	96†	59††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	←		30			→	14	30	14	←											30											7

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables Tables of Observatories in India.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—PAMBAN. LAT. 09° 16′ N. LONG. 79° 18′ E. HEIGHT ABOVE MEAN SEA LEVEL—26 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1891 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0800: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1013	83	75	84	72	83	81	4·7	4·0	2·9	5	28	52	7	0	0	0	0	8	5	38	56	4	0	0	0	0	2	0	10	—	††	††
February	1012	85	76	87	72	79	78	3·9	3·2	0·9	1	13	46	18	2	1	0	0	1	19	33	57	5	1	0	0	0	3	1	7	—	0	0
March	1010	88	77	91	73	74	76	3·4	2·9	0·9	2	3	21	29	13	6	2	1	1	24	19	26	9	17	21	4	1	2	1	6	—	0	0
April	1008	90	80	93	75	79	76	4·2	4·5	2·9	4	1	5	12	28	22	13	1	1	17	8	11	5	33	31	7	1	3	1	7	—	0	0
May	1006	94	82	93	77	79	77	3·3	3·9	1·0	2	2	1	2	10	23	42	11	2	7	1	0	0	28	50	19	1	1	0	10	—	0	0
June	1005	90	82	92	78	78	77	3·8	4·8	0·2	0	0	0	0	3	18	57	16	1	5	0	0	0	17	51	31	1	0	0	11	—	0	0
July	1006	89	80	92	77	78	79	4·3	5·4	0·3	1	0	0	0	5	19	48	13	2	13	0	0	0	21	50	26	3	0	0	9	—	0	0
August	1007	89	79	91	77	79	79	4·0	5·2	0·4	1	2	1	2	7	25	28	11	2	22	0	0	0	34	50	15	1	0	0	8	—	0	0
September	1007	89	79	91	76	79	80	3·7	5·0	0·8	1	2	1	3	7	25	30	11	5	16	0	3	0	43	42	11	1	0	0	8	—	0	0
October	1009	88	78	90	74	82	81	4·9	5·5	6·9	8	12	6	4	8	20	19	9	8	14	8	10	3	19	36	16	0	6	2	7	—	0	0
November	1011	85	77	88	73	84	81	4·9	5·2	12·0	13	28	19	5	3	8	5	6	15	11	30	33	3	7	12	3	3	7	2	8	—	0	0
December	1012	83	73	85	72	85	82	3·9	4·2	8·1	9	43	23	3	1	1	1	2	23	3	42	41	4	1	1	3	0	8	0	10	—	0	0
Means	1009	88	78	94*	71**	80	79	4·1	4·7	—	—	11	14	7	7	14	21	7	6	13	15	20	3	18	28	11	1	3	1	9	—	—	—
Totals	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme values	—	—	—	99†	66††	—	—	—	—	64·1	47	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	←	—	—30—	—	→	18	30	18	30	30	←	—	—	—	-20-	—	—	—	→	←	—	—	—	-5-	—	—	—	→	30	—	5	8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—TRIVANDRUM. LAT. 08° 29′ N. LONG. 76° 57′ E. HEIGHT ABOVE MEAN SEA LEVEL—41 FT.
CLIMATIC TABLE COMPILED FROM 5 TO 45 YEARS' OBSERVATIONS, 1841 TO 1955.

Month	Pressure at M.S.L.	Air temperature Mean				Relative humidity		Mean cloud amount		Rain		Wind direction 0830									Wind direction 1730									Mean wind speed in knots		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yd.
	‡ Mean	Daily max.	Daily min.	Highest in each month	Lowest in each month	0800	1700	0800	1730	Average fall	No. of days with 0·1 in. or more	Percentage of observations from									Percentage of observations from									§			
												N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW	Calm				
	mb.	°F.	°F.	°F.	°F.	%	%	Ok	tas	in.																							
January	1011	87	73	90	69	79	62	3·0	3·6	0·8	2	7	31	19	2	0	1	1	1	38	0	1	1	0	19	43	27	1	8	3	—	†† 0	§ 0
February	1010	88	74	91	70	79	63	2·8	3·9	0·8	1	12	32	11	1	0	0	1	5	38	1	0	0	0	18	32	42	4	3	3	—	0	0
March	1010	89	76	92	73	80	67	2·3	4·3	1·9	3	22	18	7	1	0	0	2	15	35	2	1	1	1	7	22	52	6	8	4	—	0	0
April	1009	89	77	92	74	82	72	4·5	6·0	4·6	7	28	8	3	1	0	0	1	28	31	5	3	4	0	5	9	47	17	10	4	—	0	0
May	1008	88	78	91	74	83	75	5·2	5·9	9·4	10	29	4	1	1	0	1	5	43	16	6	0	0	0	1	4	46	40	3	5	—	0	0
June	1009	84	76	88	73	88	81	6·7	6·9	12·2	19	28	2	1	0	0	1	10	47	11	11	0	0	0	0	2	43	43	1	5	—	0	0
July	1009	83	73	87	72	90	80	6·8	6·8	7·8	15	31	1	0	0	0	0	6	57	5	12	0	0	0	0	0	30	58	0	6	—	0	0·1
August	1009	84	75	87	72	89	78	6·2	6·3	5·9	11	32	0	0	0	0	0	7	56	5	10	0	0	0	0	0	34	55	1	6	—	0	0
September	1009	85	75	88	73	86	76	5·5	5·8	5·5	9	29	1	0	0	0	0	6	53	11	7	0	0	1	0	1	38	48	5	6	—	0	0
October	1009	85	75	88	72	87	79	5·9	6·6	10·5	12	19	4	0	1	0	1	5	30	40	7	5	3	0	4	7	47	25	2	4	—	0	0·1
November	1010	85	74	88	71	87	76	4·5	5·7	7·3	10	11	11	6	2	1	1	3	12	53	8	5	1	1	15	13	22	9	26	3	—	0	0
December	1011	86	73	89	69	81	67	3·3	3·9	2·8	4	9	25	17	2	0	0	2	4	41	3	3	0	0	8	33	34	5	14	2	—	0	0·6
Means	1010	86	75	93*	68**	84	73	4·7	5·5	—	—	21	11	5	1	0	0	4	30	28	6	1	1	0	6	14	39	26	7	4	—	—	—
Totals	—	—	—	—	—	—	—	—	—	69·5	103	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0·8
Extreme values	—	—	—	96†	66††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	45	←		30		→	23	30	23	30	30	←				20				→	←				5				→	30	—	5	10

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—COCHIN. LAT. 09° 58′ N., LONG. 76° 14′ E. HEIGHT ABOVE MEAN SEA LEVEL—10 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1881 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0830: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1011	87	74	90	69	70	63	4·4	4·3	0·6	0·8	5	46	40	2	1	0	0	0	6	0	1	0	0	0	14	66	19	0	4	—	0	0
February	1011	87	76	90	71	73	66	4·7	4·3	1·2	2	7	44	38	3	3	0	0	1	4	0	0	0	0	0	9	60	31	0	5	—	0	0
March	1010	88	78	91	73	74	71	4·7	4·5	1·9	3	8	50	30	4	0	0	0	1	7	1	0	0	0	0	4	56	39	0	6	—	0	0
April	1009	88	79	88	73	76	73	5·9	5·7	5·4	7	8	41	30	5	1	0	2	5	8	0	2	2	2	3	4	53	33	1	6	—	0	0
May	1008	88	78	90	73	82	78	6·7	6·7	11·6	12	6	28	29	10	2	1	4	6	14	6	5	5	4	2	6	27	42	3	6	—	0	0
June	1009	84	75	88	72	89	84	7·4	7·4	30·8	25	6	14	20	13	3	9	11	6	19	5	3	2	3	1	9	33	35	9	5	—	0	0
July	1009	82	74	86	72	90	85	7·5	7·5	22·6	24	7	14	16	6	3	7	16	12	19	4	2	0	1	1	5	35	47	5	5	—	0	0
August	1009	82	73	85	72	87	85	7·2	7·4	14·6	19	8	19	14	3	2	4	12	16	22	4	0	0	1	1	6	39	48	1	5	—	0	0
September	1010	83	75	86	73	85	82	6·7	6·9	9·8	14	9	27	19	6	2	3	7	11	16	3	1	0	1	0	3	27	64	1	5	—	1	0
October	1010	84	75	87	73	84	79	6·7	7·1	13·2	15	5	26	30	10	2	3	3	4	17	1	2	3	5	3	15	43	25	3	4	—	0	0
November	1010	86	75	89	73	81	73	5·7	6·1	7·1	9	4	34	36	9	1	1	1	1	13	3	2	3	4	5	15	46	17	5	4	—	0	0
December	1011	86	74	89	70	74	65	4·7	4·8	1·9	3	4	47	40	3	0	0	0	0	6	2	3	0	1	1	15	50	27	1	4	—	0	0
Means	1010	85	75	92*	69**	80	75	6·0	6·1	—	—	6	34	29	6	1	2	5	5	12	2	2	1	2	1	9	45	36	2	5	—	—	—
Totals	—	—	—	—	—	—	—	—	—	120·7	133	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0
Extreme values	—	—	—	93†	64††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	←		30		→	18	30	18	30	30	←				20				→	←					5				→			8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time : Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.
‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—MANGALORE. LAT. 12° 52′ N., LONG. 74° 51′ E. HEIGHT ABOVE MEAN SEA LEVEL—54 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1881 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0830: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																								
January	1011	88	71	93	67	73	62	2·4	2·0	0·2	0	3	12	69	8	0	0	0	0	8	3	0	0	0	0	15	11	71	0	4	—	††	††
February	1011	87	73	93	69	76	65	2·2	1·9	0·1	0	7	19	50	6	0	0	0	1	17	4	0	0	0	0	7	14	75	0	5	—	0	0
March	1009	89	76	93	72	75	65	2·4	2·4	0·4	1	14	19	37	6	1	0	0	1	22	1	0	1	0	0	3	13	82	0	5	—	0	0
April	1008	90	78	92	73	73	68	4·1	4·3	1·8	3	16	17	26	6	1	1	2	7	24	1	1	0	1	1	11	15	70	0	5	—	0	0·1
May	1007	90	79	92	72	77	70	5·4	4·9	7·8	8	19	11	17	6	3	2	4	17	21	4	1	0	1	3	7	11	73	0	5	—	0	0
June	1007	85	75	90	72	91	85	7·1	7·2	38·6	25	5	6	24	10	5	10	18	8	14	2	1	3	5	6	30	25	25	3	5	—	0	1
July	1007	83	76	87	71	92	87	7·4	7·6	40·8	29	5	5	11	5	3	8	32	16	15	0	2	0	1	3	39	29	22	4	5	—	0	1
August	1008	83	74	84	72	92	85	7·1	7·1	23·2	25	7	6	9	4	2	6	21	14	31	5	1	1	1	3	21	27	38	3	4	—	0	0·7
September	1009	84	74	86	72	90	82	6·2	6·3	11·4	19	9	9	23	7	4	3	7	9	29	6	1	0	3	1	15	17	55	2	4	—	0	0·3
October	1009	85	75	90	72	86	77	5·2	5·9	9·0	11	8	10	44	10	2	2	2	4	18	2	1	1	4	11	15	21	44	1	4	—	0	0·3
November	1010	89	74	92	69	77	69	3·8	4·2	2·7	4	2	15	62	9	1	0	0	1	10	6	2	1	3	8	13	13	49	5	4	—	0	0·1
December	1011	89	71	92	67	70	61	2·8	2·6	0·7	1	1	17	66	8	1	0	0	0	7	3	1	2	2	1	7	12	71	1	4	—	0	0
Means	1009	87	75	94*	66**	81	73	4·7	4·7	—	—	8	12	36	7	2	3	7	7	18	3	1	1	2	3	15	17	56	2	4	—	—	—
Totals	—	—	—	—	—	—	—	—	—	135·7	126	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	5
Extreme values	—	—	—	99†	63††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	←		30		→	18	30	18	30	30	←				20				→	←					5				→		8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time—Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

§Mean of 0800 and 1700 hrs. observations.
‡Mean of 24 hrs.

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PLACE—MORMUGÃO. LAT. 15° 25′ N., LONG. 73° 47′ E. HEIGHT ABOVE MEAN SEA LEVEL—25 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1891 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0830: N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yd.
												Percentage of observations from									Percentage of observations from												
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1012	85	70	91	69	70	60	1·7	1·7	0·1	0	9	19	50	11	3	0	0	2	6	1	0	3	0	1	31	36	28	0	5	—	††	††
February	1012	84	71	90	66	74	64	1·9	1·6	0	0	22	18	29	13	5	1	0	4	8	0	0	0	0	1	15	40	45	0	6	—	0	0
March	1010	86	75	91	70	74	68	2·5	2·1	0	0	21	16	18	10	9	3	2	12	9	0	0	0	0	0	15	34	51	0	6	—	0	0
April	1008	87	79	91	74	76	68	3·7	3·0	0·8	1	26	12	9	5	8	6	4	17	13	0	0	0	0	3	13	45	39	0	7	—	0	0
May	1008	89	79	91	75	78	71	4·4	3·9	2·4	2	20	8	4	3	4	3	16	34	8	0	0	0	1	3	4	41	51	0	7	—	0	0
June	1006	85	76	89	71	86	82	6·1	6·0	30·9	22	7	4	3	6	11	15	31	16	7	1	1	0	1	4	30	50	13	0	9	—	0	0
July	1006	82	75	85	72	89	87	6·5	6·6	32·6	27	7	1	2	3	4	11	51	16	5	1	1	0	0	0	25	58	15	0	11	—	0	0
August	1007	82	75	84	72	85	85	5·9	5·9	16·0	22	4	4	1	1	3	12	44	17	14	2	1	0	0	1	16	55	25	0	9	—	0	0
September	1009	83	74	85	72	85	83	5·5	5·5	9·1	15	9	6	9	5	6	5	13	14	23	1	1	0	0	3	16	38	41	0	6	—	0	0
October	1009	86	75	92	71	83	77	4·5	4·7	6·0	7	5	13	20	11	9	4	3	7	28	1	1	1	2	13	20	43	19	0	5	—	0	0·1
November	1011	88	74	92	68	69	64	2·8	3·2	1·5	2	4	26	41	11	5	2	1	1	9	1	1	1	1	5	28	46	17	0	5	—	0	0
December	1012	87	71	91	67	64	58	1·9	2·1	0·2	0	5	26	49	9	5	1	0	1	4	0	1	4	1	1	25	40	28	0	5	—	0	0
Means	1009	85	75	96*	65**	78	72	3·9	3·9	—	—	12	13	19	7	6	5	14	12	12	1	1	1	1	3	19	44	30	0	7	—	—	—
Totals	—	—	—	—	—	—	—	—	—	99·4	98	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0·3
Extreme values	—	—	—	99†	62††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	←	—	30	→	25	18	30	18	30	30	←	—	—	—	20	—	—	—	→	←	—	—	—	—	5	—	—	—	—	—	→	8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—RATNÁGIRI. LAT. 16° 59′ N., LONG. 73° 18′ E. HEIGHT ABOVE MEAN SEA LEVEL—221 FT.

CLIMATIC TABLE COMPILED FROM 2 TO 60 YEARS' OBSERVATIONS, 1881 to 1940.

Month	Pressure at M.S.L.	Air temperature Mean				Relative humidity		Mean cloud amount		Rain		Wind direction 0830									Wind direction 1730									Mean wind speed in knots		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yd.
												Percentage of observations from									Percentage of observations from												
	Mean	Daily max.	Daily min.	Highest in each month	Lowest in each month	0830	1730	Ok	tas	Average fall	No. of days with 0·1 in. or more	N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW	Calm	0830	1730		
	mb.	°F.	°F.	°F.	°F.	%	%			in.																						
January	1012	87	67	94	61	56	62	—	—	1·0	0·4	8	17	40	20	2	0	0	0	13	15	0	1	1	0	6	26	51	0	4	7	0	0
February	1012	85	67	93	61	61	63	—	—	0·0	0·3	17	21	29	14	2	0	0	2	15	11	0	0	1	0	6	26	56	0	4	9	0	0
March	1010	87	72	93	66	67	68	—	—	0·0	0·3	29	20	16	14	4	1	0	4	12	14	0	0	0	3	15	28	40	0	4	8	0	0
April	1009	89	77	93	72	70	71	—	—	0·1	0·8	32	12	6	11	7	3	1	14	14	10	1	1	0	1	11	35	41	0	4	8	0	0
May	1007	90	80	93	76	69	71	—	—	1·1	3	22	7	2	5	4	8	12	28	12	6	0	0	0	1	13	36	44	0	4	8	0	0
June	1005	87	77	91	73	80	83	—	—	30·4	24	7	4	5	14	8	22	20	12	8	2	0	0	1	6	41	33	17	0	5	7	0	0
July	1005	84	76	87	73	84	89	—	—	33·9	30	2	2	2	7	4	38	36	5	4	2	0	0	0	2	43	44	9	0	9	9	0	0
August	1007	83	75	85	73	84	87	—	—	19·1	28	3	2	2	4	1	30	39	10	9	2	0	0	0	1	30	50	17	0	8	7	0	0
September	1008	84	75	87	72	82	83	—	—	11·8	20	12	11	10	12	5	7	14	8	21	6	0	0	0	0	18	33	43	0	4	7	0	0
October	1009	88	74	96	70	73	77	—	—	4·3	8	13	12	24	19	6	2	1	4	19	13	2	1	1	4	18	25	41	0	4	6	0	0
November	1011	91	71	95	65	55	65	—	—	1·0	2	3	11	46	24	2	0	1	0	13	14	2	0	1	1	4	29	49	0	5	5	0	0
December	1012	89	68	94	63	50	61	—	—	0·1	0·6	4	15	48	20	2	0	0	0	11	17	1	1	0	1	4	31	45	0	5	6	0	0
Means	1009	87	73	97*	60**	69	73	—	—	—	—	13	11	19	14	4	9	10	7	13	9	1	0	0	2	17	33	38	0	5	7	—	—
Totals	—	—	—	—	—	—	—	—	—	102·1	117	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0
Extreme values	—	—	—	102†	54††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	60	60	60	60	50	5	—	—	60	10	←				20				→	←				5				→	2	2	10	10

Authorities: M.S. data supplied by Indian Meteorological Service, Poona.

Standard time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

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PLACE—BOMBAY. LAT. 18° 54′ N., LONG. 72° 49′ E. HEIGHT ABOVE MEAN SEA LEVEL—58 FT.
CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1881 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0830: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1013	84	67	91	61	72	62	1·2	1·1	0·2	0·3	15	42	31	8	1	1	0	1	1	37	1	0	0	0	0	8	53	1	5	—	0	0
February	1012	85	68	92	62	73	62	1·0	0·8	0	0·1	19	36	30	10	1	1	1	1	1	26	0	0	0	0	0	11	63	0	5	—	0	0
March	1010	87	72	94	67	73	62	1·5	1·0	0	0·1	23	26	20	19	4	1	1	2	4	30	0	0	0	0	1	13	56	0	5	—	0	0·3
April	1008	90	77	94	74	74	65	2·3	1·1	0·1	0·2	21	12	13	16	11	9	4	8	6	17	0	0	0	0	2	18	63	0	6	—	0	0
May	1007	91	80	94	77	74	67	3·5	2·6	0·5	1	13	3	5	7	9	17	20	22	4	3	0	0	0	1	13	35	48	0	5	—	0	0
June	1004	89	79	94	76	82	77	5·8	5·5	18·4	15	3	2	1	12	16	25	28	12	1	1	0	0	0	3	28	46	21	1	7	—	0	0·4
July	1003	86	77	89	74	87	83	6·9	6·0	26·6	24	1	1	1	2	3	29	50	12	1	1	1	0	0	1	26	53	18	0	8	—	0	0
August	1005	85	77	88	74	86	82	6·7	6·7	14·0	18	2	1	1	2	2	25	49	17	1	2	0	0	0	1	15	51	31	0	7	—	0	0·3
September	1007	86	76	89	73	86	79	5·7	5·5	12·2	12	6	8	10	16	9	14	20	15	2	12	0	0	0	1	13	34	39	1	5	—	0	0
October	1009	90	76	95	72	82	72	3·3	3·2	3·0	4	9	32	31	13	4	3	1	5	2	26	0	0	1	3	4	10	55	1	5	—	0	0
November	1011	90	73	94	69	72	65	1·1	1·2	0·9	1	4	39	42	11	1	1	0	1	1	31	1	0	1	1	1	6	59	0	5	—	0	0
December	1013	87	69	92	64	71	61	1·6	0·8	0·1	0·3	6	43	40	9	0	0	0	1	1	31	1	0	0	0	0	4	63	1	5	—	0	0
Means	1009	87	74	97*	60**	78	70	3·4	3·0	—	—	10	20	19	10	5	11	15	8	2	18	0	0	0	1	9	24	48	0	6	—	—	—
Totals	—	—	—	—	—	—	—	—	—	76·0	76	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	1·1
Extreme values	—	—	—	105†	53††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	←		—30—		→	23	30	23	30	30	←				—20—				→	←					—5—				→		8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time : Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—SURAT. LAT. 21° 12 N., LONG. 72° 50′ E. HEIGHT ABOVE MEAN SEA LEVEL—64 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 50 YEARS' OBSERVATIONS, 1881 TO 1955.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0830: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1730: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots §		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																							
January	1014	89	59	94	51	63	38	1·7	1·5	0·1	0	27	19	20	6	3	0	2	6	17	12	7	3	0	1	16	32	27	2	3	—	0	0·3
February	1013	92	62	100	51	61	36	1·2	1·1	0·1	0	27	18	15	6	6	1	1	7	19	6	4	1	1	10	29	28	20	1	3	—	0	0·3
March	1011	97	68	106	60	62	32	1·4	1·4	0	0	25	10	6	7	12	7	3	7	23	8	3	0	0	9	24	28	27	1	3	—	0	0·3
April	1008	99	74	109	69	64	40	1·6	1·5	0·2	0	21	8	2	5	21	13	5	7	18	5	1	0	1	15	34	25	19	0	4	—	0	0
May	1006	97	80	103	75	69	57	2·5	2·3	0·1	0	6	2	1	3	29	31	13	3	12	1	0	0	1	31	50	13	4	0	6	—	0	0
June	1002	92	81	99	75	78	69	5·4	5·3	7·6	8	2	1	1	7	27	33	20	4	5	0	0	0	3	40	49	7	1	0	6	—	0	0
July	1002	86	78	92	74	85	80	7·1	7·1	17·7	17	1	1	1	4	21	35	25	6	6	0	0	0	0	32	57	9	2	0	6	—	0	0·1
August	1004	86	77	91	74	86	78	6·9	6·9	9·1	13	2	0	0	3	14	33	32	7	9	0	0	0	0	30	60	10	0	0	6	—	0	0
September	1007	92	76	96	73	85	71	5·5	5·5	8·7	9	10	3	3	5	13	12	21	11	22	3	2	1	1	27	48	12	5	1	4	—	0	0·1
October	1010	92	74	100	68	71	46	2·7	2·5	1·3	2	16	13	18	10	10	3	2	3	25	11	16	11	3	10	16	16	14	3	3	—	0	0
November	1012	92	66	98	60	59	39	1·6	1·5	0·7	1	11	22	36	10	2	1	0	2	16	19	30	9	2	1	13	14	9	3	3	—	0	0
December		58	92	54	61	39	1·4	1·1	0·1	0	17	23	31	8	2	1	0	3	15	21	23	6	2	1	6	19	17	5	3	—	0	0
Means	1009	92	71	109*	49**	70	52	3·3	3·1	—	—	15	10	11	6	13	15	10	5	15	7	7	3	1	17	34	18	12	1	4	—	—	—
Totals	—	—	—	—	—	—	—	—	—	45·7	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	1·1
Extreme values	—	—	—	114†	40††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	30	30	30	30	30	23	30	23	30	30	←				20				→	←						5				→	8	

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of Time: Indian Standard time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—DWÁRKA. LAT. 22° 22′ N., LONG. 69° 05′ E. HEIGHT ABOVE MEAN SEA LEVEL—19 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 40 YEARS' OBSERVATIONS, 1901 TO 1955.

Month	Pressure at M.S.L.	Air temperature Mean				Relative humidity		Mean cloud amount		Rain		Wind direction 0830									Wind direction 1730									Mean wind speed in knots		No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	‡ Mean	Daily max.	Daily min.	Highest in each month	Lowest in each month	0800	1700	0800	1700	Average fall	No. of days with 0·1 in. or more	Percentage of observations from									Percentage of observations from									§			
												N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW	Calm				
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																					
January	1015	77	59	84	53	66	45	1·7	1·3	0·1	0	34	35	8	1	0	2	4	11	5	19	17	5	0	0	2	10	47	0	7	—	†† 0	†† 0·1
February	1014	80	63	85	56	71	57	1·5	1·3	0·1	0	33	24	6	1	0	3	9	22	2	6	8	3	0	1	7	33	42	0	8	—	0	0·3
March	1012	83	71	94	63	75	67	1·7	1·3	0·0	0	22	8	1	1	1	8	23	34	2	4	2	1	0	0	5	47	41	0	8	—	0	0
April	1009	85	76	95	70	79	71	1·9	1·0	0·0	0	6	1	0	0	3	22	40	27	1	1	0	0	0	0	11	65	23	0	9	—	0	0·1
May	1006	88	80	90	78	81	74	2·8	2·5	0·0	0	1	0	0	0	9	44	38	8	0	0	0	0	0	5	45	46	4	0	10	—	0	0
June	1001	89	83	92	81	80	76	4·7	4·7	1·6	2	1	1	2	1	12	49	28	5	1	1	1	0	0	3	58	36	1	0	12	—	0	0
July	1000	86	80	92	76	85	80	7·3	6·7	8·6	7	0	1	0	1	6	56	32	3	1	0	0	0	0	4	60	35	1	0	14	—	0	0
August	1003	85	79	87	76	85	80	7·3	6·3	3·1	4	0	0	0	0	5	56	36	3	0	0	0	0	0	2	56	41	1	0	12	—	0	0
September	1007	85	78	88	75	83	76	4·5	3·9	1·8	2	4	1	0	1	6	34	37	14	3	0	0	0	0	0	33	55	12	0	8	—	0	0
October	1011	86	75	96	67	77	75	1·9	1·3	0·1	0	22	10	3	3	4	12	18	24	4	4	1	1	0	0	6	44	44	0	6	—	0	0·1
November	1013	87	67	94	63	67	51	1·1	1·0	0·1	0	34	34	10	1	0	1	3	14	3	13	23	4	0	1	1	15	43	0	6	—	0	0
December	1015	81	61	88	56	65	42	1·5	1·3	0·1	0	32	43	14	0	0	1	1	6	3	26	26	5	0	0	1	7	35	0	6	—	0	0
Means	1008	84	73	98*	52**	76	66	3·2	2·7	—	—	16	13	4	1	4	24	22	14	2	6	7	2	0	1	24	35	25	0	9	—	—	—
Totals	—	—	—	—	—	—	—	—	—	15·7	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0·4
Extreme values	—	—	—	106†	43††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	40	←	—	—30—	—	→	23	30	23	30	30	←	—	—	—	—20	—	—	—	→	←	—	—	—	—5—	—	—	—	→	30	—	5	8

Authorities: Delhi, India Weather Review.
Poona, M.S. data supplied by Indian Meteorological Office.
Delhi, Climatological Tables of Observatories in India.

Standard of time: Indian Standard Time.
Meteorological Office, Air Ministry.

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.

‡Mean of 0800 and 1700 hrs. observations.
§Mean of 24 hrs.

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PLACE—KARĀCHI. LAT. 24° 48′ N., LONG. 66° 59′ E. HEIGHT ABOVE MEAN SEA LEVEL—13 FT.

CLIMATIC TABLE COMPILED FROM 5 TO 59 YEARS' OBSERVATIONS, 1881 TO 1940.

Month	Pressure at M.S.L. ‡ Mean	Air temperature Mean: Daily max.	Daily min.	Highest in each month	Lowest in each month	Relative humidity: 0800	1700	Mean cloud amount: 0800	1700	Rain: Average fall	No. of days with 0·1 in. or more	Wind direction 0800: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1700: Percentage of observations from N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed in knots 0800	1700	No. of days with wind speed > force 8.	No. of days with visibility < 1,100 Yds.
	mb.	°F.	°F.	°F.	°F.	%	%	Oktas		in.																								
January	1016	75	57	82	51	63	44	2·3	2·9	0·5	1	27	34	10	2	2	4	8	12	1	2	9	9	10	13	37	15	4	1	6	8	—	0·1
February	1014	77	61	84	53	72	55	2·1	2·3	0·4	1	24	25	9	2	1	7	14	17	1	1	4	3	4	8	47	30	3	0	5	9	—	0·5
March	1011	82	68	91	60	79	58	2·0	2·4	0·3	0·6	12	6	2	0	2	17	40	21	0	3	2	2	2	2	48	38	3	0	5	12	—	0
April	1008	85	74	93	68	87	70	2·1	1·3	0·1	0·2	4	2	1	0	1	31	51	10	0	0	0	0	0	0	59	38	3	0	7	13	—	0
May	1004	89	79	96	75	88	76	2·5	1·9	0·1	0·1	1	1	0	1	3	38	51	5	0	0	0	0	0	3	65	32	0	0	10	14	—	0·3
June	999	90	82	95	79	86	74	4·5	3·8	0·7	0·6	1	1	1	1	2	44	47	3	0	1	0	0	0	3	70	25	1	0	12	16	—	0
July	998	89	81	93	77	88	77	6·1	5·4	3·2	3	1	0	0	0	2	41	50	6	0	1	1	0	1	3	67	26	1	0	11	15	—	0
August	1000	86	79	89	75	90	76	6·3	5·3	1·6	2	0	0	0	0	1	39	56	4	0	1	0	0	0	1	58	39	1	0	10	13	—	0
September	1005	86	77	91	73	89	75	4·9	2·6	0·5	0·5	2	1	0	0	1	32	58	6	0	0	0	0	0	0	60	40	0	0	8	11	—	0·3
October	1010	87	74	96	68	83	72	1·4	0·6	0·0	0·1	15	11	3	0	2	18	33	18	0	0	0	0	0	1	58	40	1	0	4	10	—	0·5
November	1014	85	67	92	61	68	53	1·2	1·3	0·1	0·3	32	26	7	2	3	6	9	15	0	1	6	4	4	3	46	33	3	0	4	9	—	0·4
December	1016	79	60	85	54	64	48	1·8	2·2	0·2	0·5	33	38	7	1	2	5	5	9	0	1	9	10	5	14	44	14	2	1	5	8	—	0
Means	1008	84	72	—*	—**	80	65	3·1	2·6	—	—	13	12	3	1	2	24	35	10	0	1	3	2	2	4	55	31	2	0	7	11	—	—
Totals	—	—	—	—	—	—	—	—	—	7·7	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Extreme values	—	—	—	109†	43††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	49	←		—29—		→	5	49	5	59	59	←				—22—				→	←					—5—							→

Authorities: M.S. data supplied by Pakistan Meteorological Service, Karāchi. *Meteorological Office, Air Ministry.*

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.
§Mean of 24 hrs.

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CHAPTER II

MALDIVE AND LACCADIVE ISLANDS

Chart 748b.

MALDIVE ISLANDS.—General remarks.—For a general description of these islands, *see* page 1. Much of the following information relating to small details, such as heights, existence of trees and depths in channels, is very old, as but little information can be derived from places so seldom visited. Dates of the last definite information on these matters have been inserted in the text.

Among the different atolls of the Maldive group there are several good deep channels; some of these are, however, intricate and require local knowledge; the latter should be avoided by vessels of low power as the currents set strongly through them in an easterly or westerly direction, according to the season.

Besides the channels which separate the different atolls, there are numerous openings through their barrier reefs, which are also very deep. These openings are difficult to discern beyond a distance of from 3 to 4 miles, the reefs appearing as one continuous line to a vessel approaching them. When within one to 2 miles, the channels can be distinctly seen when the sun is in a favourable position.

Within the atolls good anchorage may be obtained in very smooth water of moderate depth, coral and sand.

By day, all the channels between the atolls and even those amongst the islets and reefs, may be passed through without anxiety if the sun is in a favourable position, as all the sunken coral dangers are generally visible at some distance from the masthead.

At night, a vessel should only pass through the four larger channels between the atolls, and not even through these unless the entrance has been made before dark, or the latitude is accurately known.

The boat channels leading over the reefs to the villages on the inhabited islands are, in most cases, marked by stakes embedded in the coral. The natives clear the weed from the bed of these channels, which makes their outline distinct and easy to follow.

The inhabitants of the Maldives (*Lat. 6° 00′ N., Long. 73° 00′ E.*) are not permitted to barter or accept gifts of any sort without the sanction of the Sultan, and this order is enforced by the headmen of the villages. If it is required, the Sultan will authorise a representative to accept Ceylon currency in exchange for foodstuffs, chiefly chickens, eggs and fish.

Water.—Water can be obtained from many of the islands and islets in this group, such islands and islets being indicated on the charts, but, as this information is very old, it cannot be depended upon. This water should not be used for drinking purposes without taking the

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Chart 748b.

usual precautions. There are no facilities for supplying this water to shipping.

Radar information.—In 1960, H.M.S. *Scarborough* reported that the coral islands on the atolls could be detected by radar at a range of just over 20 miles, and the arrangement of individual islands could be obtained at 15 miles. The breakers on the edges of the reefs were detected at about 2 miles. *See* also Appendix III on page 346.

Currents.—In February 1960, H.M.S. *Gambia* when passing about 25 miles eastward of Suvadiva and Mulaku atolls experienced a set of 1½ knots in a 270° direction; this set continued until Wadu channel was reached.

In October 1960, H.M.S. *Scarborough* reported a southerly set of about one knot off the eastern side of the atolls between Male island and latitude 2° 30′ N.

Climate and weather.—*See* page 29.

Chart 2067.

ADDU ATOLL AND FUA MULAKU ISLAND.—Addu atoll.—Aspect.—Addu atoll (*Lat. 0° 40′ S., Long. 73° 10′ E.*), the southernmost of the Maldive group, is the smallest of the southern atolls, and is fertile. It lies on the southern side of Equatorial channel and consists of a number of islands and islets situated on a barrier reef surrounding a central lagoon. The barrier reef, which dries, extends about half a mile to seaward of the islands but its outer limits are only approximately charted. Four deep channels through the barrier reef provide entrances to the lagoon, which has general depths of from 10 to 41 fathoms (18^{m}3 to 75^{m}0).

The western islands and islets are, on the whole, much more densely wooded than the eastern ones, and, instead of being covered with scrub, have several large trees on them.

The main village is on Hitaddu, which lies at the north-western corner of the atoll. There are smaller villages on Midu, situated at the north-eastern corner, and on Gan, Maradu and Fedu, which lie on the south-western side of the atoll.

In 1942 the population of the atoll was 5,500. In 1940, the Atoluveri or chief headman resided on Midu.

Winds are generally between north-west and south-west, through west, light to moderate, but heavy squalls are occasionally experienced; easterly winds are generally light. The average shade temperature is about 85° with a humidity of 82%.

Currents.—Addu atoll and Equatorial channel lie in the northern part of the course of the Equatorial counter-current, and the predominant current direction appears to be eastward or north-eastward throughout the year. Current observations are, however, scanty in this region, but it is probable that marked variations of current direction occur.

Within a distance of 40 to 50 miles from the atoll the current has been observed to increase considerably in strength. *See* also page 62.

Gan.—Towers.—Lights.—Moorings.—Jetty.—Pipeline.—Gan (*Lat. 0° 41′ S., Long. 73° 10′ E.*), the south-westernmost island of Addu atoll, lies at the south-eastern end of the western part of the barrier reef, which surrounds the lagoon. In 1960, the island was given to the British Government for 30 years.

Charts 66c, 2398, 748b.

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Chart 2067.

Gan is very fertile; both its northern and southern sides are sandy, and, in 1940, it was thickly wooded. There is an airfield on the island, and a village is situated at the north-western end.

Two black square water towers, about 30 feet (9m1) in height, stand on the northern side of the island about 5 cables from the north-western end; they are conspicuous from northward. Two wooden towers, 90 feet (27m4) in height, lie immeditaely westward and about 7 cables south-eastward, respectively, of the water towers.

Four other wooden towers, 120 feet (36m6) in height and from each of which a *red* obstruction light is exhibited, stand close south-westward of the water towers.

Off the northern side of the island there are a number of moorings immediately outside the edge of the barrier reef, which extends about one cable offshore. A concrete jetty, 444 feet (135m3) long, lies about 3 cables eastward of the north-western extremity of the island; there is a channel 50 feet (15m2) wide and 7½ feet (2m3) deep on either side of the jetty.

A fixed pipeline extends 336 feet (102m4) from a position about 1¾ cables south-eastward of the root of the jetty, as far as the edge of the coastal reef; there are two mooring buoys outside the edge of the reef north-westward and north-eastward of the end of the pipeline.

Tankers using the pipeline anchor and secure their sterns to the mooring buoys.

Addu island lies on the barrier reef about one cable off the south-western side of Gan.

Submarine cable.—*See* page 61.

Anchorages.—There is safe anchorage, in a depth of about 25 fathoms (45m7) good holding ground of coral, from 3½ to 5 cables northward of the jetty on the northern side of Gan; there is very little swell here, but farther inside the lagoon the swell is moderate to heavy. In 1960, H.M.S. *Scarborough* anchored in 25 fathoms (45m7) with the jetty bearing 165° distant 7½ cables. Care must be taken to avoid the submarine cable in the vicinity of these anchorages. *See* caution on page 61.

Pilotage.—No pilot is available but a Royal Air Force officer with local knowledge will board vessels on request to advise masters on suitable anchorages, local facilities and weather conditions.

Directions.—*See* page 61.

Facilities.—The facilities on the island of Gan are extremely limited; no water, fuel or supplies are available.

Western side of Addu atoll.—Beacon.—The western part of the barrier reef surrounding the lagoon extends from a position about half a mile south-eastward of Gan (*Lat. 0° 41′ S., Long. 73° 10′ E.*) in a north-westerly direction for about 9½ miles to a position about half a mile westward of the western extremity of Hitaddu, where it is steep-to, and about a quarter of a mile north-eastward of the northern extremity of the same island.

Fedu, close north-westward of Gan, was, in 1934, thickly wooded; its north-western side was sandy, and had a gentle slope. It is connected to Gan by a ruined concrete causeway. Several small islets lie close to the western side of Fedu island; a rock, which dries 4 feet (1m2), is situated about 2½ cables south-westward of its south-eastern extremity.

Charts 66c, 2898, 748b.

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Chart 2067.

Maradu, close north-westward of Fedu, is almost steep-to on the eastern side of its south-eastern extremity, which, in 1940, was thickly wooded.

A beacon stands near the village on the north-eastern side of the island about 6 cables from the north-western extremity.

The islet of Hankada, with a small islet close southward of it, lies about one cable north-north-westward of the north-western extremity of Maradu. Abuhera, situated between Hankada and Hitaddu, is thickly wooded.

Hitaddu, the largest island of the atoll of which it forms the north-western corner, is thickly wooded.

A large village, in which there are three mosques, is situated on the northern part of the island. A boat channel leads from the lagoon to the village; after passing between the islets of Mahira and Komudi, the channel is marked by strips of clean sand, the weed having been removed.

Northern side.—From Demon point, the northern extremity of Hitaddu, the outer edge of the barrier reef trends about 2 miles south-eastward and then about 1½ miles eastward to the western entrance point of Kudu Kanda channel. Man Kanda channel lies about 8 cables eastward of Kudu Kanda channel and between these two deep channels there is a portion of the barrier reef on which lie two sand cays; the eastern cay is known as Bushy islet and has a summit of trees.

From the eastern entrance point of Man Kandu channel the barrier reef extends about 5½ miles east-north-eastward to the north-eastern extremity of Midu. Mahira island and Hikahera islet, with several smaller islets, lie on the reef close off the north-western extremity of Midu.

Midu, the north-eastern island of the atoll, is steep-to eastward of its north-eastern extremity and is almost entirely composed of sand. The village of Midu is situated at the north-western corner of the island, and that of Huludu at the southern end; elsewhere, in 1940, the island was thickly wooded.

Eastern side.—Close south-westward of Midu (*Lat. 0° 35′ S., Long. 73° 14′ E.*) lies the narrow island of Heratera, which extends southward for about 2½ miles. The northern part of the island was, in 1940, thickly wooded and there were some trees and bushes elsewhere along its length. The islet of Firhidu Hera lies close to its southern extremity with that of Kalu Hera close south-south-westward of it. The islet of Mulikadu is situated about three-quarters of a mile farther south-south-westward. There was, in 1940, a prominent coconut palm on each of these two latter islets.

Wilingili island lies with its north-eastern end about 1½ miles south-westward of Mulikadu islet and stands on a detached reef. It was uninhabited in 1940, and had two prominent tree summits near its northern end. There are openings into the lagoon on either side of this island; the north-eastern opening is known as Wilingili channel and the western opening as Gan channel.

Chart 66c.

Outlying dangers.—Breakers, reported by the s.s. *Itola* in April 1914, are charted about 19 miles east-south-eastward of the southern extremity of Midu (*Lat 0° 36′ S., Long. 73° 14′ E.*).

Charts 2898, 748b.

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Chart 2067.

Lagoon. — Dangers. — Beacons. — Buoyage. — The reef, which fringes the islands, extends about half a mile into the lagoon, except in the north-eastern and north-western corners where it extends much further, and in the south-western corner where it is less than 2 cables wide off Gan and Fedu. The north-western and north-eastern corners of the lagoon are encumbered with coral reefs and have not been thoroughly examined. Vessels are advised not to approach these areas too closely.

For a description of the northern side of Gan *see* page 58.

A coral patch, with a depth of less than 6 feet (1^{m}8) over it, lies about 1½ miles north-north-westward of the western extremity of Gan; it is marked by a beacon near its north-eastern extremity but, in 1958, this beacon was reported to have collapsed. A red can light-buoy, exhibiting a *red flashing* light *every five seconds*, is moored off the eastern side of this patch. Another coral patch, with a least depth of 15 feet (4^{m}6), is situated about 3 cables westward of the above danger.

A mooring buoy is situated about 6½ cables north-north-westward of the above beacon.

A shoal, with a least depth of 28 feet (8^{m}5), lies about 1½ miles north-eastward of the north-western extremity of Maradu; it is marked by a black conical light-buoy, exhibiting a *white flashing* light *every three seconds*.

A 2-fathom (3^{m}7) patch lies about one mile north-westward of the 28-foot (8^{m}5) shoal described above; it is marked on its south-eastern side by a black spherical buoy.

Shoals, with least depths of 40 and 60 feet (12^{m}2 and 18^{m}2), lie about one mile south-south-eastward of Bushy islet.

Two coral reefs, which dry, lie in the centre of the lagoon about 1¾ and 2¼ miles, respectively, north-north-westward of the northern extremity of Wilingili island; the northern one is known as Aruhal and the southern as Medagala.

A shoal, with a least depth of 16 feet (4^{m}9), lies about one cable off the southern extremity of Medagala reef with a 27-foot (8^{m}2) patch between. The western edge of the shoal is marked by a black conical light-buoy, exhibiting a *white flashing* light *every five seconds*.

Patches, with depths of 7 and 9 fathoms (12^{m}8 and 16^{m}5), lie about half a mile southward and 1½ miles south-south-westward, respectively, of Medagala reef (*Lat. 0° 39′ S., Long 73° 11′ E.*).

Channels.—Buoyage.—Beacon.—The lagoon can be entered from northward through Kudu Kanda or Man Kanda channels, and from southward through Wilingili or Gan channels. The latter are to be preferred as they are broader and less intricate.

Kudu Kanda channel is about 1¼ cables wide between the reefs on either side, which are steep-to; it has a least depth in the fairway of 13 fathoms (23^{m}8).

Man Kanda channel is about 1¾ cables wide between the shoal ground which extends from the reefs on either side; it has a least depth of 40 feet (12^{m}2) in the fairway.

The south-western extremity of the shoal ground on the north-eastern side of the channel is marked by a red can light-buoy, exhibiting a *red flashing* light *every second*. A black conical light-buoy, exhibiting a *white flashing* light *every second*, is moored on the south-western side

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Chart 2067.

of the channel off the eastern extremity of the shoal ground extending eastward from Bushy islet.

A shoal, with a least depth of 6 fathoms (11m0), extends about 2½ cables south-eastward from the black conical light-buoy above.

Wilingili channel is about 4 cables wide between the fringing reefs on either side; it has a least depth of 10 fathoms (18m3) except for a shoal, with a least depth of 40 feet (12m2), which lies at the lagoon end of the channel close off the reef on the south-western side.

Gan channel is about 4 cables wide between the reefs and has depths of from 9 to 10 fathoms (16m5 to 18m3) in the fairway.

The north-eastern side of the channel is marked by a black conical light-buoy, exhibiting a *white flashing* light *every second*. The south-western side of the channel is marked by a red can light-buoy, exhibiting a *red flashing* light *every second*.

A red can light-buoy, exhibiting a *white flashing* light *every second*, is moored south-westward of the entrance to the boat channel leading to Hitaddu village, in the north-western corner of the lagoon; a white pillar beacon, about 8 feet (2m4) in height, stands on a detached drying patch about 1½ cables south-westward of the light-buoy just mentioned.

Submarine cable.—A submarine cable, as indicated on the chart, is laid between the islands of Gan (*Lat. 0° 41′ S., Long. 73° 10′ E.*) and Hitaddu. Vessels are warned not to anchor within 5 cables of this cable, which carries a high voltage. *See* page 26.

Anchorages.—During the north-east monsoon a vessel with local knowledge can anchor off the western side of the eastern islands, and during the south-west monsoon off the north-eastern side of the south-western islands; these are the most convenient anchorages for communicating with the inhabitants.

For the anchorage off Gan *see* page 57.

Caution.—Swell, which is experienced inside the lagoon from time to time during the south-west monsoon, causes conditions such that refuelling alongside a tanker or storing ship may be difficult.

Tidal streams.—The flood stream sets strongly into the lagoon through Wilingili channel and out of the lagoon through Gan channel, but the ebb stream sets out of the lagoon through both these channels; thus whereas in Wilingili channel there is a reversal of the tidal stream with the change of tide, in Gan channel the stream sets continuously out of the lagoon.

In Kudu Kanda channel, the tidal streams set into the lagoon with the flood tide and out of it with the ebb, but in Man Kanda channel, the tidal streams set continuously out of the lagoon.

Directions.—The two southern openings into the lagoon are to be preferred as they are broader and less intricate.

Gan channel.—Approaching Gan channel from north-eastward the islets of Heratera, Firhidu Hera, and Kalu Hera, give the appearance of a single island. No difficulty is experienced in navigating Gan channel, the sides being marked by light-buoys and the reefs usually outlined by breakers. Bushy islet bearing 342° leads through the channel in a least depth of 9 fathoms (16m5).

Although Gan channel (*Lat. 0° 41′ S., Long. 73° 11′ E.*) is marked by light-buoys a daylight approach is recommended.

Wilingili channel.—A north-westerly course leads through this channel; care is necessary to avoid Aruhal and Medagala reefs and the

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Chart 2067.

two shoals which lie between these reefs and the northern extremity of Wilingili island.

Man Kanda and Kudu Kanda channels.—These two openings on the northern side of the lagoon are not easily discerned by a vessel approaching from northward.

A south-south-easterly course leads through Man Kanda channel between the light-buoys on either side. Kudu Kanda channel is longer and narrower.

Chart 66c.

Equatorial channel.—Current.—The channel between Addu atoll and Suvadiva atoll, about 46 miles northwards, is known generally as Equatorial channel, but Fua Mulaku island, about 20 miles north-eastward of Midu, lies midway between Addu atoll and the equator, so that Equatorial channel proper is between Fua Mulaku and Suvadiva atoll; there are no known dangers between Addu and Suvadiva atolls.

In November 1939, a 5-knot current, setting east-north-eastward, was experienced in Equatorial channel.

In 1940, a set of 5 knots, varying in direction from 060° to 080°, was experienced in this channel; the current appeared to be setting more strongly in the northern half of the channel.

In February 1960, a set of 2 knots in a 260° direction was experienced between Addu atoll and Fua Maluka; this increased to 5½ knots in a 270° direction as the centre of Equatorial channel was approached. In the northern half of the channel the set became 5½ knots in a 235° direction, and this strength and direction was maintained to a position 15 miles eastward of Suvadiva atoll.

In October 1960, a set of 1½ to 1¾ knots in a 100° direction was experienced in the northern part of the channel.

Caution.—In 1960, H.M.S. *Scarborough* reported that Fua Mulaku island lay about 5 miles eastward of its charted position relative to Suvadiva atoll, and that the island had extended about half a mile in a south-easterly direction.

Fua Mulaku island.—Fua Mulaku island (*Lat. 0° 18′ S., Long. 73° 26′ E.*) is wooded, the trees being from 70 to 90 feet (21m3 to 27m4) high in 1837.

The poulation in 1926 was 2,185. A small supply of eggs, fruit and poultry may be obtained.

Tidal streams.—The ebb stream sets westward, and the flood eastward in the vicinity of Fua Malaku island, but they are little felt, except in retarding or accelerating the currents.

Anchorage.—Fua Mulaku island is steep-to on its western, northern, and eastern sides, but a shelving bank, on which the surf breaks heavily for a distance of three-quarters of a mile offshore, extends about 1½ miles south-south-eastward from the southern end of the island; this bank is composed of hard sand, with small coral rock, and is steep-to.

Vessels can obtain anchorage, during moderate weather, on the southern end of this bank, in depths of from 6 to 7 fathoms (11m0 to 12m8). *See* caution above.

The landing place is about half-way along the eastern side of the island, and can be recognised by a collection of boat sheds. Landing on the western side is dangerous, and should not be attempted.

SUVADIVA ATOLL.—Suvadiva or Huvadu atoll is one of the

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Chart 66c.

largest of the Maldive group; it is the unhealthiest of the atolls. Elephantiasis is said to be common, and cases of leucodermia have been reported; isolation of such cases is strictly enforcedby the Government. The islets on the barrier reef are numerous, but not all are inhabited. There are many islets in the centre of this atoll and there are greater depths in the lagoon than in those of the other atolls, and it is also less obstructed by coral reefs. The total population of the atoll, in 1926, was 7,020.

Suvadiva atoll is the centre of the mat industry in the Maldives, as the rush from which the mats are made is found there in abundance. Gadu, an islet on the south-eastern side of the atoll, about 35 miles northward of Fua Mulaku island, is where they are chiefly made.

South-western side.—Matoda (*Lat. 0° 13′ N., Long. 73° 06′ E.*) stands at the western end of the southernmost coral reef of Suvadiva atoll, and is separated from Fiori, an islet 3 cables westward, by a deep channel; this coral reef, on which there are several islets, extends about 4¼ miles east-south-eastward from Matoda, and about 1½ miles east-south-eastward from Bandara, the easternmost islet on this reef.

Fiori was inhabited in 1926.

From Fiori the barrier reef trends in a north-westerly direction for about 7 miles to Nadale.

The islets of Retafudu and Kaudu are situated on this part of the reef, about 2 and 4½ miles, respectively, north-westward of Fiori.

From Nadale the reef extends in a north-north-westerly direction for about 10 miles to close northward of Madaveli. This reef, which forms the south-western side of the atoll, is densely encumbered with many smaller islets, and presents, on some bearings, the appearance of one large island.

Hondedu is an island close southward of Madaveli.

Kandudu opening, close northward of Madaveli, is the most convenient for vessels, and may be said to be the principal entrance into Suvadiva lagoon. It is a good passage, three-quarters of a mile wide, with depths of not less than 6 fathoms (11^{m}0).

An islet on which, in 1836, there was a single coconut tree and some low bushes, lies about 3 miles northward of Madaveli; there is a narrow channel close southward of it, which has a least depth of 6 fathoms (11^{m}0) in the fairway.

Havaru Tinadu, the southern end of which is situated about half a mile northward of the islet just mentioned, was, in 1926, the most densely populated islet in Suvadiva atoll; it is very low and swampy in parts.

From the south-westward or westward Havaru Tinadu appears to be the northernmost island or islet of the atoll, due to the absence of any wooded islands or islets along the barrier reef, which here trends in a north-easterly direction.

The channel southward of Havaru Tinadu is less than one cable wide, and has a least depth of 6 fathoms (11^{m}0) in the fairway. It is a safe channel, and its southern side is well defined by the islet with the single coconut tree, described above.

North-western side.—Between Havaru Tinadu (*Lat. 0° 32′ N., Long. 72° 57′ E.*) and Mafuri, an islet about 21 miles north-north-eastward, the north-western side of the barrier reef recedes, forming a bight; as already stated there are no wooded islets here, nor are there any

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Chart 66c.

landmarks, but merely heaps of coral and sand, on only two of which were any bushes seen in 1836. Mahuta, an islet about 9½ miles north-eastward of Havaru Tinadu, and Fulangi, an islet about 6 miles east-north-eastward of Mahuta, near which there are openings in the barrier reef, were both uninhabited in 1926.

Atamandu, an islet on the barrier reef about 6¾ miles northward of Fulangi, and Lusa, an islet 1½ miles north-westward of Atamandu, were both uninhabited in 1926.

Mafuri, the principal islet at the north-western point of the atoll, had a population of about 400 in 1926. It stands one mile from the northern point of its fringing reef, which extends also 4 miles south-eastward from Mafuri. Another islet, about one-third the size of Mafuri, and which shows conspicuously, lies about 1½ cables south-eastward of that islet.

Landing is at the village situated near the centre of the eastern side of Mafuri. The boat channel is not marked, and at low water landing on the beach can only be made by boats of very shallow draught.

Kandugili, an islet about 1½ miles north-north-eastward of Mafuri, was, in 1926, uninhabited.

Hibadu (*Lat. 0° 51′ N., Long. 73° 12′ E.*), an islet lying within the lagoon about 3 miles east-south-eastward of Kandugili, is marked by the absence of palms, and by magnificent trees of luxurious growth and great height. It was uninhabited in 1926; the islet is very unhealthy.

The islets of Huradu and Gula lie about 1¼ miles northward and southward, respectively, of Hibadu; the former was inhabited in 1926.

Northern side.—On its northern side Suvadiva atoll is bounded by several detached coral reefs; there are no islands or islets on the northern verge of this portion of the barrier reef, though a few lie about 2 miles within it; the principal one is the island of Matu, which lies about 6 miles east-north-eastward of Hibadu.

Eastern side.—The north-eastern side of the barrier reef extends for about 11 miles in a south-south-easterly direction, and is impassable.

Mametu, situated about 4½ miles from the northern end of the reef, consists of two islets, which, when approaching from north-eastward, are generally the first islets to be seen; these islets were, in 1926, uninhabited.

Wiringili, with the islets of Falawaru and Raverea lying close northward of it, is an islet standing on the southern extremity of this part of the barrier reef, and had, in 1926, many inhabitants.

Kudu, an islet half a mile southward of Wiringili, was, in 1926, uninhabited.

The channel between Wiringili and Kudu is about 2 cables wide, with at least a depth of 12 fathoms (21^{m}9) in the fairway.

Mandu, an islet about half a mile southward of Kudu, lies at the northern end of a reef which extends for about 4 miles in a southerly direction; there are five other islets on this portion of the barrier reef. Mandu was uninhabited in 1926.

The channel between Kudu and Mandu has a least depth of 13 fathoms (23^{m}8) in the fairway.

Nilandu, an island situated about 3¾ miles southward of Mandu, was, in 1926, inhabited and had some supplies.

There is an opening, with a least depth of 13 fathoms (23^{m}8), between the fringe of the reef extending southward from Nilandu and that

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Chart 66c.

extending north-westward from the islet of Dandu, about three-quarters of a mile south-eastward. The reef on which Dandu stands extends south-eastward for about two miles, its extremity fringing the islet of Hura Mula.

Between the last-mentioned reef and the reef extending north-westward from Mamadu, an islet about 2 miles south-eastward of Hura Mula, there is an opening with a least depth of 6 fathoms (11m0) in the fairway; close southward of Mamadu, and between it and the reef on which stands the islet of Wegeli, there is another opening, with a least depth of 8 fathoms (14m6) in the fairway.

Funadu (*Lat. 0° 34′ N., Long. 73° 28′ E.*), an islet 1½ miles southward of Mamadu, has an opening southward of it, in which there is a least depth of 10 fathoms (18m3) in the fairway. There is also an opening between Wegeli and Funadu, with a least depth of 9 fathoms (16m5).

Kondai is an island situated about 2¾ miles south-south-eastward of Funadu. Diaddu, an islet situated about half a mile south-south-eastward of Kondai, stands on a reef which extends about 1½ miles west-south-westward and about one mile south-south-eastward from the islet, which was uninhabited in 1926.

Between Kondai and Diaddu there is a narrow opening with a least depth of 17 fathoms (31m1) in the fairway.

Mawaru, an islet half a mile southward of Diaddu reef, has an opening on its northern side, with a least depth of 7 fathoms (12m8) in the fairway; this opening leads in a westerly direction towards Lillis, an islet about 1½ miles westward of the northern end of Mawaru.

The reef on which Mawaru stands trends in a southerly and south-westerly direction for about 7 miles to the south-western end of Kandu Huludu, the south-easternmost islet of Suvadiva atoll; there are several islets on this portion of the barrier reef, of which Kubura, situated about 1½ miles north-eastward of Kandu Huludu, is the largest.

The opening between the reef on which Kandu Huludu stands and the reef west-south-westward is about half a mile wide, with depths of from 7 to 8 fathoms (12m8 to 14m6) in the fairway; this opening is defined on its western side by an island, named Huluwarolu (*Lat. 0° 21′ N., Long. 73° 27′ E.*), on which, in 1926, there were a number of coconut trees.

Southern side.—From the north-eastern end of Huluwarolu the barrier reef trends in a south-westerly direction for about 5½ miles; just within its south-western end is an islet, called Gadu. There are several islets on this reef, which, from the offing, appear as one.

There is a passage south-westward of Gadu, but it is narrow, and has a least depth of 2 fathoms (3m7) in the fairway.

From the south-western side of the passage just described the barrier reef extends in a south-westerly direction for about 2¼ miles; on this reef is Gan, the largest island of Suvadiva atoll.

Gan is wooded and very fertile; it is temporarily occupied during the cultivation season.

Gan channel, southward and westward of Gan, is about 1½ miles wide, with a least depth of 30 fathoms (54m9) in the fairway. An islet, about 2 miles north-north-westward of the south-western end of Gan, can be passed on either side, but care must be taken to avoid the reef extending about 1¼ miles south-south-westward from it, and also

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Chart 66c.

Low Bushy island, which lies off the western end of the reef. Within the entrance of this channel the lagoon is encumbered with islets and reefs, but all are plainly visible from aloft in a favourable light; Hakaru, an islet 4 miles north-north-westward of the islet just mentioned, was, in 1926, uninhabited; an islet about half a mile westward of Hakaru had, in 1902, some high trees on it.

Between the western side of the southern entrance to Gan channel and Wadu, an island 7 miles west-south-westward, there are four openings in the barrier reef. The islets of Sihura, Rasfanu and Kuri stand on the reefs forming these openings, about 3, 5½ and 7½ miles westward, respectively, from the south-western extremity of Gan. The two eastern channels lead in a north-north-westerly direction with least depths of 4½ and 6 fathoms (8m2 and 11m0) in the fairway, and the next channel to the west leads in a northerly direction, and has a least charted depth of 20 fathoms (36m6) in the fairway.

Close northward of Wadu lies the westernmost channel, which is narrow, with depths of from 25 to 40 fathoms (45m7 to 73m2) in the fairway; on the northern side of this channel is a bank, with charted depths of from 3 to 10 fathoms (5m5 to 18m3). The tidal streams are, at times, strong in this channel, which leads in a westerly direction into the lagoon.

Wadu (*Lat. 0° 14′ N., Long. 73° 13′ E.*) is just within the north-eastern edge of a reef which extends in a south-westerly direction for 3½ miles. Prior to 1836 the island was very fertile and sustained a large population, but, in 1926, there were only a few inhabitants. Its ancient mosques and burial places are worth visiting.

There is a good channel, close westward of the reef extending south-westward from Wadu, leading in a north-north-westerly direction into the lagoon; this channel has a least depth of 7 fathoms (12m8) in the fairway.

Anchorages.—Hondedu (page 63) affords good anchorage during the south-west monsoon to vessels with local knowledge off its eastern side in depths of from 27 to 35 fathoms (49m4 to 64m0).

Anchorage may be obtained in the lagoon, with Mafuri (page 63) bearing 267°, distant one mile, in a depth of 10 fathoms (18m3).

The principal approach to the anchorage eastward of Mafuri is through the opening on the north-eastern side of the barrier reef extending northward from Mafuri; this opening is about one mile wide, but Kandugili (page 64) divides it into two channels, of which the south-western is shallow, with a least depth of 4 fathoms (7m3), while the north-eastern is deep, with a least depth of 34 fathoms (62m2). Care must be taken to avoid some islets and reefs southward and south-eastward of Kandugili, by keeping a good look-out from the masthead.

There is well-sheltered anchorage on the western side of Nilandu (page 64) during the north-east monsoon. Vessels with local knowledge can enter the lagoon either northward or southward of the reef on which Nilandu stands; a westerly course leads through the northern channel, but care must be taken to avoid a coral reef lying in the centre of the fairway; a west south-westerly course leads through the southern channel, which has a least depth of 13 fathoms (23m8) in the fairway.

Anchorage can be obtained by vessels with local knowledge on the western side of Kondai (page 65).

Charts 2898, 748b.

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Chart 66c.

Good anchorage can be obtained about half a mile north-westward of Gadu island, and also off Gan island (page 65).

General directions.—Along the southern face of Suvadiva atoll, in a distance of 25 miles, there are nine passages leading into the lagoon.

Between Havaru Tinadu (*Lat. 0° 32′ N., Long. 72° 57′ E.*) and Mafuri there are numerous openings through the barrier reef leading into the lagoon. As already stated, along this part of the barrier reef there are no landmarks, but in case of emergency a vessel might proceed through one of the openings, with a good look-out at the masthead. The best of these openings are northward of Mahuta and in the vicinity of Fulangi.

On the northern side of Suvadiva atoll there are also many safe passages through the barrier reef, but when using these a careful look-out must be kept, as there are no islets on the verge of this part of the barrier reef.

In addition to the opening south-westward of Kandu Huludu (page 65) there are a number of other entrances to the lagoon along the eastern face of the atoll.

One and half degree channel.—One and half degree channel, between Suvadiva atoll and Haddummati atoll, about 52 miles northward, is deep and free from dangers.

Currents.—In November 1939, a 3½-knot current, setting eastward, was experienced. In October 1960, a current of 1½ to 3½ knots, setting eastward, was observed.

Charts 66b, 66c.

HADDUMMATI AND KOLUMADULU ATOLLS.—Haddummati atoll.—Haddummati atoll has six openings through the barrier reef surrounding it, of which four are available for large vessels. The interior of the atoll has numerous coral reefs, all of which are discernible from the masthead to a vessel approaching them on a clear day, when the sun is in a favourable position.

The principal occupation of the inhabitants is cultivation. In 1926 the population was 2,980.

Chart 66c.

Southern side.—Off-lying banks.—Hitadu is an island on the western side of the southern opening into the lagoon. It is fringed on all sides by a barrier reef which extends to its greatest distance of about half a mile at its southern extremity. In 1926, the population was 279.

The islet of Kunahandu lies close westward of Hitadu and the two islets present the appearance of a single island.

The southern opening is between the eastern extremity of the reef just mentioned and the reef extending a short distance westward from Gadu (*Lat. 1° 49′ N., Long. 73° 27′ E.*), an island about 2½ miles east-north-eastward of Hitadu; the passage is about 2 miles wide and is deep. Three reef-fringed islets lie close together just within this entrance on the western side of the centre, and form two passages into the lagoon; one leads in a northerly direction eastward of the islets, and the other turns westward between the northern side of Hitadu and the southern side of the three islets, after passing which several coral reefs lie in the fairway, which are discernible from aloft on a clear day.

Banks, with depths of 9 and 12 fathoms (16^{m}5 and 21^{m}9), lie about

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Chart 66c.

1½ miles south-eastward of the north-eastern extremity, and a similar distance south-westward of the south-western extremity of Funadu, an island on the atoll reef about 1¾ miles eastward of Gadu.

South-western side.—From eastward of Hitadu the barrier reef extends about 12 miles north-westward to about one mile northward of Mavaru, and forms the south-western side of the atoll. There are a number of smaller islets on this reef, the two largest being Phares and Kakuni.

Mavaru, at the western extremity of the atoll, is its principal islet. It contained in 1926 nearly 400 inhabitants.

Mavaru opening is situated 1½ miles northward of the islet; it was described in 1836 as a narrow but safe channel, although no soundings are recorded. There are two islets on the north-eastern side of this opening.

Charts 66b, 66c.

North-western side.—From Mavaru opening the barrier reef trends in a north-easterly direction for about 3 miles to a projecting elbow; Suaroge is the northernmost of the two islets situated near its southern extremity, and the islet of Apura stands inside the elbow; from thence the reef extends in a north-easterly direction for about 5 miles to Munafuri, which consists of two islets lying close together.

Chart 66b.

The opening north-eastward of Munafuri has depths of from 3 to 3½ fathoms (5^{m}5 to 6^{m}4) in the fairway, but depths of 6 fathoms (11^{m}0) are charted.

From the north-eastern side of the opening just described the barrier reef extends for about 2 miles in an east-north-easterly direction to the islet of Waduni.

There is an opening eastward of Waduni, between that islet and two sandbanks on the barrier reef eastward; it is about 2 cables wide, with depths of from 10 to 17 fathoms (18^{m}3 to 31^{m}1) in the fairway.

From this last opening the barrier reef trends in an east-north-easterly direction for about 14½ miles to just eastward of Isdu island which, in 1836, was well covered with coconut trees, and formed a good landmark.

Eastern side.—From Isdu (*Lat. 2° 07′ N., Long. 73° 35′ E.*), the barrier reef trends in a south-south-westerly direction for about 6 miles to Mabadu, an islet which, in 1926, was inhabited; there are several islets on this portion of the barrier reef, including those of Dambidu, Dekunu and Furi, the last of which is inhabited.

There is an opening in the barrier reef on either side of Mabadu; the southern, between it and the island of Mandu, is the better of the two, having depths of 8 fathoms (14^{m}6), while the northern only has depths of from 3 to 4 fathoms (5^{m}5 to 7^{m}3); each is about 2 cables wide. The islets which form the northern side of the northern opening are uninhabited.

Charts 66b, 66c.

From Mandu the barrier reef trends in a southerly, south-westerly, and westerly direction for about 15 miles to Gadu, and has many islands and islets on it, of which Baresdu and Karaidu, about one mile and 2 miles southward, respectively, of Mandu, are inhabited. Gang, about 4 miles southward of Mandu, and also inhabited, is the largest; in 1926, vegetables were obtainable on the island.

Charts 2898, 748b.

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Charts 66b, 66c.

Kadu and Funadu also stand on this portion of the reef, about one mile and 3 miles south-south-westward, respectively, from the southern extremity of Gang. There are high trees on Funadu, which is also inhabited.

Chart 66c.

The opening westward of Gadu is described on page 67.

Anchorages.—In 1920, H.M.S. *Odin* entered through the southern opening and anchored in a depth of 24 fathoms (43m9) northward of Hitadu. An easy landing was effected from a cutter on a sandy beach, after passing over the reef which extends about one cable offshore; the edge of this reef is very clearly defined.

Good anchorage may be obtained during westerly winds about three-quarters of a mile eastward of Mavaru in depths of from 17 to 20 fathoms (31m1 to 36m6).

Chart 66b.

Veimandu channel.—Veimandu channel, between Haddummati atoll and Kolumadulu atoll, about 16 miles north-westward, is deep and free from dangers, but it is not advisable to proceed through it at night.

Tidal streams.—Both the east-going and west-going tidal streams in Veimandu channel have a rate of about 2 knots at springs, but their rate is accelerated or retarded by the prevailing current. H.M.S. *Diana* reported that, in February 1918, she found the west-going stream had a rate of 3 knots.

Current.—In October 1960, a current of from 1¾ to 3½ knots, setting in an 070° direction, was experienced by H.M.S. *Scarborough* in Veimandu channel.

Kolumadulu atoll.—Kolumadulu atoll has a number of openings in its barrier reef; there are several islets along its southern edge, but few along its northern margin; numerous coral reefs, which dry, encumber the lagoon, and there are a few islets on its western side.

Southern and western sides.—Veimandu (*Lat. 2° 11′ N., Long. 73° 06′ E.*), an islet situated on the western side of the westernmost of the southern openings in the barrier reef, was inhabited in 1926.

From Veimandu the barrier reef has a westerly direction for about 8 miles to the western extremity of the islet of Naraka, and from thence trends in a north-north-westerly direction for about 5½ miles to the islet of Hirilandu; there are several islets on this part of the barrier reef, including Kimbudu, about 1½ miles south-westward of Veimandu, and Humadu, which is inhabited, about 2 miles westward of Kimbudu.

Between Hirilandu and Kandudu, an islet 2¼ miles north-north-westward, is the only opening on the western side of the barrier reef; it is about 1¾ miles wide, but is contracted by a reef, part of which is above water, lying in the centre of the opening, with an islet close eastward of it. Vessels proceeding through this opening can avoid this reef by keeping on the southern or northern sides of the opening, where it is deep; if using the northern entrance, care must be taken to avoid the southern edge of the barrier reef, which extends nearly half a mile southward from the southern extremity of Kandudu.

From Kandudu the barrier reef has a northerly and north-easterly direction of about 15½ miles to an islet, called Kandufuri; with the exception of Kandudu, Kandufuri, and Weligandu, an islet about 2 miles northward of Kandudu, and uninhabited in 1926, there are no

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Chart 66b.

islands or islets on this portion of the barrier reef. Kandufuri had many coconut trees on it in 1902; it was uninhabited in 1926.

There is an opening in the barrier reef about 1¼ miles west-south-westward of Kandufuri, and there is also an opening close eastward of that islet; both channels are deep.

Northern side.—On the northern side of this atoll there are several openings in the barrier reef, reported to be safe though narrow, but only three have been examined; the opening close eastward of Buruni, an islet about 6½ miles east-north-eastward of Kandufuri (*Lat. 2° 32′ N., Long. 78° 00′ E.*), has a depth of 7 fathoms (12m8) in the fairway; the easternmost of the northern openings is close eastward of Olugeri, an islet 9 miles east-south-eastward of Buruni, and has a least depth of 5 fathoms (9m1) in the fairway.

The islets of Koragandu and Lohi stand on detached reefs, about 3 and 7½ miles east-south-eastward, respectively, of Buruni.

All the islets on the northern side of the atoll were, in 1902, densely wooded; Buruni then had many coconut trees on it, and Wilifuri, an islet 3 miles eastward of Olugeri, also had a number of coconut trees on it, and was densely populated in 1926.

Eastern side.—From about half a mile northward of Wilifuri the barrier reef has a general southerly direction for about 12 miles to an islet, called Diyagili, and has no openings in it.

Fahala island, the northern extremity of which is situated about 3¾ miles south-south-eastward of Wilifuri, stands on the barrier reef, and defines the eastern extremity of the atoll; it had, in 1836, a number of coconut trees on it, and was uninhabited in 1926; the eastern and southern sides of this island were reported in 1902 as being washed away.

The island of Mudufuri, which is inhabited, is situated about 1½ miles southward of the southern extremity of Fahala. There are several unnamed islets between it and Diyagili.

Between Diyagili, which is steep-to on its south-eastern side, and Guradu, an island about one mile west-south-westward, there is an opening in the barrier reef, which has a least depth of 8 fathoms (14m6); the least charted depth is 19 fathoms (34m7). There is a tide-rip across this opening.

Diyagili was inhabited in 1940, and a boat harbour had been built at the north-western end of the island by erecting a coral wall on the reef to seaward of the small lagoon off the village.

In 1940, there was a large village on Guradu, consisting of mortar huts and houses, some of the latter having tiled roofs. The island was divided by a natural boat channel, the northern entrance to which was protected by a wall of coral.

South-eastern side.—From close north-eastward of Guradu the barrier reef trends in a south-westerly direction for about 13 miles to close westward and southward of the islet of Timarafuri. Between Guradu and Timarafuri the barrier reef is encumbered with islets which include Lowadu and Gadifuri, situated about 1½ miles and 7½ miles south-westward, respectively of Guradu (*Lat. 2° 20′ N., Long. 73° 19′ E.*).

Between Timarafuri and Veimandu (page 69) there are three openings in the barrier reef; the easternmost of these openings, close south-westward of Timarafuri, has a least depth of 35 fathoms (64m0) in the

Charts 2898, 748b.

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Chart 66b.

fairway, and is free from dangers. The middle opening, betwen an unnamed islet, three-quarters of a mile south-westward of Timarafuri, and Kanimidu, an island which was uninhabited in 1926, half a mile farther west-south-westward, has a least depth of 6 fathoms (11m0) in the fairway; a vessel proceeding through this latter channel must keep on the western side, so as to avoid some rocks on the eastern side. The westernmost opening, between Kanimidu and Veimandu, is broad and deep, but just within the entrance is a large coral reef.

Anchorages.—Vessels can anchor either on the eastern side of Hirilandu (page 69), or the eastern side of Kandudu (page 69), according to the prevailing wind.

Kuda Huvadu channel.—Kuda Huvadu channel, between Kolumadulu atoll and Nilandu and Mulaku atolls, is deep and free from dangers; the southern end of Nilandu atoll is about 9½ miles northward of the north-eastern end, and Mulaku atoll about 15 miles north-north-eastward of the north-eastern end, of Kolumadulu atoll.

The western entrance of this channel is well defined on its northern side by Kuda Huvadu, an islet 10 miles north-north-westward of Kandufuri. The southern boundary is not so well defined, as Kolumadulu atoll, at its north-western end, has no islands or landmarks, except Kandufuri (*Lat. 2° 32′ N., Long 73° 00′ E.*); Buruni, farther eastward, is more prominent.

Currents.—Tidal streams.—The currents in Kuda Huvadu channel are more obstructed than in the channels through the Maldive group, already described, owing to the number of atolls in this vicinity; consequently their direction is uncertain and their rate greater.

The tidal streams set eastward through Kuda Huvadu channel with the flood tide, and westward with the ebb.

NILANDU AND MULAKU ATOLLS.—Nilandu atoll.—Nilandu atoll consists of two separate atolls, South Nilandu atoll and North Nilandu atoll, which are separated from each other by a channel, 3½ miles wide; this channel is deep and free from dangers.

South Nilandu atoll.—South Nilandu atoll has many openings in the barrier reef, but is not accessible on its south-western side.

The lagoon is deep, but is encumbered with large and small coral reefs, some of which dry; these coral reefs are steep-to, and easily discernible. There are many islets in the lagoon, the greater number of which are in the northern part and about 3 miles from the northern end of the atoll.

On the barrier reef on the eastern side of the atoll, there are numerous islets which are in one part thickly grouped together, but there are only a few islets on the barrier reef on the western side.

Western side.—Kuda Huvadu (*Lat. 2° 41′ N., Long. 72° 54′ E.*), at the southern end of South Nilandu atoll, was inhabited in 1926.

From Kuda Huvadu the barrier reef extends north-westward for about 3 miles to close northward of the islet of Gadifuri; from thence it extends northward for about 9 miles; there are no openings in this part of the reef.

Between the northern edge of this reef and Huludali, an island one mile northward, which was inhabited in 1926, is an opening in the barrier reef, in which the least charted depth is 15 fathoms (27m4);

Charts 2898, 748b.

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Chart 66b.

reefs extend about three-quarters of a mile south-eastward, and about half a mile north-eastward, from Huludali.

Between Huludali and Madali, an islet 1¼ miles north-north-westward, which was uninhabited in 1926, is another opening, with a least depth of 19 fathoms (34m7) in the fairway. This opening is better defined than the one southward of Huludali. A reef extends about a quarter of a mile eastward from Madali.

North-western side.—From Madali the barrier reef trends in a northerly direction for about 3¼ miles; between the northern edge of this portion of the barrier reef and Furi, an islet about 12¼ miles north-eastward of Madali, there are three openings; as the reefs which separate these openings have no islets on them, and the various islets, whose trees are visible from a distance lie about 3 miles within the lagoon, the north-western side of this atoll is unsafe to approach.

Dures (*Lat. 2° 56′ N., Long. 72° 54′ E.*), which was uninhabited in 1926, is an islet about 3 miles north-eastward of Madali. Another islet, known as Rimbudu, and which was inhabited in 1942, lies about half a mile north-eastward of Dures. These two islets are called Jewellers islands owing to the fact that the inhabitants were, formerly, the chief jewellers for the Maldive islands.

Anchorages.—In a south-westerly swell, anchorage north-eastward of Rimbudu will be found more comfortable than that shown on the chart southward of the island.

Eastern side.—Furi is the northernmost islet on the eastern side of the atoll; there is an opening in the barrier reef close south-eastward of it. It was uninhabited in 1926.

From Furi the barrier reef trends in a southerly direction for about 16 miles to Kandimas, which lies at the south-eastern end of the atoll and is the southernmost of about twenty islets on one reef. Between Furi and Kandimas there are seven openings in the barrier reef, the first six being at intervals of about 2 miles The islets of Viliwaru, Konipafuri, Male Faro, Huluwa and Farmidere, stand on this portion of the reef, about 2, 5, 7½, 9 and 11 miles southward, respectively, of Furi.

Between Kandimas and Wani, an islet half a mile south-westward, there is a narrow opening in the barrier reef, with a least depth of 20 fathoms (36m6) in the fairway.

South-eastern and southern sides.—From close northward of Wani, the barrier reef has a south-westerly direction for about 2¼ miles to about three-quarters of a mile beyond the south-western extremity of the islet of Hereafuri (Hee-reah-furi).

Between the south-western edge of this reef and Maimbudu, an islet 2½ miles south-westward of Wani, there is an opening in the barrier reef, with a least depth of 7 fathoms (12m8) in the fairway.

From close north-eastward of Maimbudu, the barrier reef trends in a west-south-westerly direction for about 3½ miles to Huluwalu, an islet which was uninhabited in 1926.

Between Huluwalu and Kuda Huvadu is the southernmost opening in this atoll; it is about 1½ miles wide, and has a least depth of 9 fathoms (16m5) in the fairway.

North Nilandu atoll.—North Nilandu atoll has only a few islets on its barrier reef.

Charts 2898, 748b.

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Chart 66b.

The lagoon is deep, but encumbered with coral reefs, which dry; there are also some islets in the lagoon.

Nilandu, the southernmost islet of the atoll, about 7½ miles north-westward of Furi (*see* above), was inhabited in 1926.

On the eastern side of Nilandu and between it and the western side of the reef on which stands the islet of Daumbudu, about 2 miles east-north-eastward, is situated the southernmost opening into the lagoon it is one mile wide, and had depths of from 7 to 20 fathoms (12m8 to 36m6).

There is a wide and deep passage into the lagoon at the northern end of the reef extending about 4 miles north-north-westward from Nilandu On the northern side of this passage there is a circular reef, northward which there is a deep narrow passage; thence to Hemiti southern opening the barrier reef trends in a north-north-westerly direction for about 6¼ miles.

Hemiti (*Lat. 3° 16′ N., Long. 72° 49′ E.*), the westernmost islet of the atoll, about 12½ miles north-north-westward of Nilandu, had high trees on it in 1926; it contained a small number of inhabitants who were traders. It was reported in 1926 that the sea was gradually reducing the size of Hemiti.

There are openings into the lagoon on both sides of Hemiti. That on the southern side is more than half a mile from the islet, and has a depth of 6 fathoms (11m0); the islet, which is opposite the entrance inside, may be passed on either side. The opening on the northern side of Hemiti has a depth of 13 fathoms (23m8), and lies along the edge of the reef which projects 1½ miles northward from that islet.

Ari Faro, an islet 6 miles north-eastward of Hemiti, marks the northern end of the atoll; this islet, which was uninhabited in 1926, had, in 1836, a clump of trees on it.

There is an opening with depths of from 15 to 20 fathoms (27m4 to 36m6) about 1¼ miles westward of Ari Faro, and another broad deep opening on its eastern side, with a reef in the middle. From this last opening, round the eastern boundary to the southern point of the atoll, there are other openings at distances of from one to 4 miles; some are very narrow, but all, with the one exception of the narrow passage southward of Farna, an islet 5¾ miles east-south-eastward of Ari Faro, have moderate depths.

On the reefs forming this eastern boundary stand the islets of Hekara, Nipafuri and Feartu, about 2, 3 and 5 miles south-south-eastward, respectively, of Farna; Mawafuri, about one mile southward of Feartu; and Adago and Magudu, about 3½ miles south-south-westward and 8 miles south-westward, respectively, of Mawafuri.

There are some shoals in the opening between Feartu and Mawafuri; this latter island was uninhabited in 1926, and had, in 1902, some coconut trees on it and was also reported as being reduced in size by the sea. The islet within the lagoon, about three-quarters of a mile westward of Adago, had coconut trees on it in 1902.

Channel eastward of Nilandu atoll.—The channel between Nilandu atoll, westward, and Mulaku and Felidu atolls, eastward, is about 18 miles wide, deep, and free from dangers.

Mulaku atoll.—Mulaku atoll consists of a number of islets, eight of which were inhabited in 1926, with a total population at that date of 1,744; all these islets lie on the barrier reef, with the exception of

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Chart 66b.

the largest, Mulaku, which is situated on the eastern side of the lagoon, about 14½ miles north-eastward of Delufuri (*Lat. 2° 46′ N., Long. 73° 24′ E.*), the southernmost islet of this atoll.

The principal occupation of the inhabitants of Mulaku atoll is cloth weaving.

There are many coral reefs in the lagoon, which has a sandy bottom.

The reefs on the southern and eastern sides of the atoll were reported, in 1920, to be extending seaward.

Southern side.—At the southern end of Mulaku atoll is a group of six islets, Delufuri being the southernmost; two of these islets, namely Kolufuri and Warefuri, situated close northward and about one mile northward, respectively, of Delufuri, were inhabited in 1926, but landing can only be effected on their western side; the nearest entrance to the lagoon here is about 2¼ miles west-north-westward of Delufuri.

Western side.—From Kureli, about 2½ miles west-north-westward of Delufuri and on which there were two coconut trees in 1902, the barrier reef trends in a northerly direction for about 24 miles to two unnamed islets, which have only a few low bushes to identify them. There are fourteen safe openings through this portion of the barrier reef, though some are very small; at almost every mile there is an opening available for entering the lagoon, and none of these channels has a less depth than 10 fathoms (18^{m}3); close southward of Tuvaru, an islet, about 7 miles northward of Kureli, there is a good channel, with depths exceeding 30 fathoms (54^{m}9), but there are coral reefs just within the entrance. Tuvaru was uninhabited in 1926.

Northern side.—From the two unnamed islets described above the barrier reef extends eastward for about 5 miles, thence south-eastward for about 8 miles, and finally eastward for about 4½ miles to the north-eastern extremity of the atoll.

There are only three islets on this northern barrier reef: Low islet (*Lat. 3° 09′ N., Long. 73° 30′ E.*), Digaru and Maduwaru, situated about 8 miles east-south-eastward, 11 and 11¾ miles south-eastward, respectively, of the two unnamed islets already mentioned. Between these latter islets and Digaru are three openings in the reef, but they are very narrow, and there are no islets by which to identify them.

Close south-eastward of Digaru and Maduwaru, which were both uninhabited in 1926, are two channels, about a quarter of a cable wide, with a least depth of 5 fathoms (9^{m}1).

Eastern and south-eastern sides.—From the north-eastern point of the atoll, the barrier reef trends in a south-south-westerly direction for about 15 miles to close southward of the islet of Buru, and thence south-westward for about 9 miles to close beyond the islet of Mahufuri, the northernmost of the group of six islets described above.

There are several other islets on this part of the reef. Of these the most noteworthy are Raimandu, which was inhabited in 1926 and lies about one mile south-south-westward of the north-eastern extremity of the reef with an unnamed islet close southward of it; Vevaru, with a population of 213 in 1926, lying about 8 miles south-south-westward of Raimandu; Muli, lying about 1¾ miles south-westward of Vevaru; Maraweli and Mafuri, with an unnamed islet midway between them, lying close southward and about 1½ miles

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Chart 66b.

southward, respectively, of Muli; and Irafuri, about 2½ miles south-westward of Buru.

The opening between Vevaru and Muli is narrowed to about 6 cables by the reefs extending from them, and though there is a deep-water channel through the opening, the entrance is intricate as there is a least depth of 3 fathoms (5m5) in places.

Mulaku village, on the north side of Mulaku island, which lies close north-westward of this opening, had, in 1926, an estimated population of 375. Local produce and fresh water are obtainable.

Wataru channel.—Wataru channel, between Mulaku atoll and Felidu atoll, is divided into two channels at its western end by Wataru reef, a small atoll; the southern channel is the wider. Both channels are very deep and the currents and tidal streams are strong.

Rakidu (*Lat. 3° 19′ N., Long. 73° 27′ E.*), the southernmost islet of Felidu atoll, marks the northern side of the channel northward of Wataru reef.

There are two low bushy islets, uninhabited in 1926, at the southern end of Waturu reef, on which, in 1902, there were some coconut trees, about 30 feet (9m1) high, that formed a good landmark. These islets stand on either side of the only entrance to the lagoon, which, however, can only be used by boats.

FELIDU AND ARI ATOLLS.—Felidu atoll.—Felidu atoll consists of several islets, seven of which were inhabited in 1926. The population, in 1926, was 2,226, the principal occupation being net making.

South-western and north-western sides.—On either side of Rakidu, the southernmost islet of Felidu atoll, there is a very narrow, deep channel leading into the lagoon; these channels are free from dangers in the fairway.

About three-quarters of a mile north-westward of Rakidu is an islet, on which there were some coconut trees in 1902; from this islet the barrier reef trends in a north-westerly direction for about 15 miles to the western extremity of the atoll; in this distance there are nine openings, but there are no landmarks to indicate their positions. From the western point of the atoll, where there is a narrow opening, the barrier reef trends in a north-easterly direction for 13 miles to Fulidu, an islet at the northern extremity of the atoll, which was inhabited in 1926; along this north-western face there are three openings, which are not easily seen.

Caution.—Between Fulidu and Gunawari, an islet 3¾ miles south-westward, the barrier reef was reported by the s.s. *Querimba*, in 1934, to have extended about one mile north-westward.

Northern, north-eastern, and southern sides.—The openings on the northern and north-eastern sides of the atoll consist of several safe, but narrow, channels. The first of these is 1½ miles eastward of Fulidu, and has a least charted depth of 5 fathoms (9m1) in the fairway; the second, about 2 miles further east-south-eastward, has a sunken rock in mid-channel; the third is about one mile eastward of Digeri, an islet 4½ miles east-south-eastward of Fulidu; the next two are on either side of Alimata, an islet about 3 miles southward of Digeri.

At the head of the bight on the north-eastern side of Felidu atoll are

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three islets, of which Tinadu (*Lat. 3° 30′ N., Long. 73° 31′ E.*), about 6½ miles south-south-eastward of Alimata, is the northernmost, with Keadu about 1½ miles south-south-eastward from it and Felidu almost midway between them. The openings between these islets and some reefs which intervene are narrow, and a heavy swell sets directly upon them in the north-east monsoon. The tidal streams and currents are strong.

Between Keadu and Foteo, an islet about 12¾ miles eastward, at the eastern extremity of the atoll, there are other openings, narrow and without landmarks; this portion of the barrier reef as well as the whole southern face of the atoll may therefore be considered one continuous reef. The north-eastern edge of the barrier reef northward of Foteo was reported in 1918, to extend about a mile farther north-eastward than charted.

From Foteo the barrier reef curves to the south-westward for about 19 miles, where its western extremity forms one side of the opening eastward of Rakidu. The islet of Buri Hura stands on this reef about 3½ miles east-north-eastward of Rakidu.

Ariyaddu and Fulidu channels.—Ariyaddu channel, between the northern end of North Nilandu atoll and the southern end of Ari atoll, about 9½ miles northward, is very deep and free from dangers.

Fulidu channel, between the northern end of Felidu atoll and the southern end of South Male atoll, about 7 miles northward, is also very deep and free from dangers.

Tidal streams.—The tidal streams, which are very strong during spring tides, set eastward through Ariyaddu and Fulidu channels with the flood tide, and westward with the ebb; the tidal streams are periodically retarded or accelerated by the current.

Ari atoll.—Ari atoll consists of a considerable number of islands and islets, the greater part of which are situated along its eastern barrier reef. In 1926, twenty of these islets were inhabited, and had a total population of 4,219. The principal occupations of the inhabitants are turtle catching and sail weaving.

This atoll, in common with those northward of it, has no continuous barrier reef round it, except for a short distance at its southern extremity.

On the western, northern and eastern sides there are numerous good passages leading into the lagoon; at the northern end of the atoll there is one very wide passage; along the eastern side there are several safe but small passages, whilst at the southern end only one break occurs in the barrier reef.

The interior of the atoll is much encumbered with coral reefs; some have depths of 2 and 3 fathoms (3^{m}7 to 5^{m}5) over them, others dry at their edges, leaving lagoons inside, but all may be avoided on a clear day by a good lookout. The influence of the spring tides is felt here.

Southern side.—Ariyaddu (*Lat. 3° 30′ N., Long. 72° 51′ E.*) and Mamigili are two islets at the southern extremity of Ari atoll; the latter islet was inhabited in 1926.

The channels into the lagoon, on either side of Ariyaddu, though narrow, are free from dangers; the eastern channel has a least depth of 28 fathoms (51^{m}2), and the western a least depth of 26 fathoms

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Chart 66b.

(47m5) in the fairway. There is a small reef about 1½ miles northward of Mamigili.

Western, northern and north-eastern sides.—Caution.—The western side of the atoll is straight in a general northerly direction, and is formed principally of large reefs, in the centre of which are lagoons; the passages between are mostly wide and deep.

Mandu, about 14 miles north-north-westward of Mamigili, Himendu, about 12½ miles northward of Mandu, Malos, about 3¾ miles northward of Himendu, Feridu, about 3 miles northward of Malos, and Matiwari, about 8 miles northward of Feridu, were inhabited in 1926. Malos and Feridu had, in 1836, high trees on them.

In 1945, a clump of palms stood on the low bushy islet about 5¾ miles northward of Mandu, and another clump stood on a bushy islet about 1¾ miles further north-north-eastward.

In 1939, a solitary tall palm stood on a small reef, situated about 5¾ miles northward of Mandu.

In 1945, the islet southward of Matiwari was covered in bushes.

The southernmost of the western openings, about 7½ miles west-north-westward of Mamigili, is narrow, as are also the next two, but the fourth and fifth are about 2 miles wide, Mandu (*Lat. 3° 43′ N., Long. 72° 42′ E.*) standing between them on a reef about 3¾ miles long. All the rest of the passages are deep and safe. The northernmost openings of the western side are situated about 1½ miles northward and southward of Matiwari.

Two low bushy islets lie about 2½ miles north-north-eastward and 5 miles north-eastward of Mandu; in the fairway between them are two small reefs. In 1945, several palm trees stood near the southern end of the former of these two bushy islets.

There is a barren sandy islet, about 3 feet (0m9) high, about one mile north-north-westward of Wehu Faro, which lies about 4½ miles north-north-westward of Feridu.

Gaha Faro, the southern end of which is situated about 1¾ miles northward of Matiwari, is a reef, within which is a lagoon, extending for about 4½ miles in a north-easterly direction. There is a similar but smaller reef about 3 miles east-south-eastward of it.

In 1836, the entrance between these reefs was broad and deep with depths of from 25 to 29 fathoms (45m7 to 53m0), but, in 1940, depths of 9 and 13 fathoms (16m5 and 22m8) were reported about 2¼ miles and one mile eastward, respectively, of the eastern extremity of Gaha Faro. From observations made in the same year it appeared that the two reefs were becoming joined by a ridge of fast-growing coral.

It is evident from these recent reports that the northern end of Ari atoll has undergone considerable change since 1836, the date of the original survey. Mariners are accordingly cautioned against placing too much reliance on the chart.

Ukulahu, an islet at the north-eastern extremity of the atoll, about 7 miles east-north-eastward of Matiwari, was inhabited in 1926. There is a good channel westward of this islet.

About three-quarters of a mile northward of Ukulahu is an islet, which, in 1942, had practically disappeared, and about the same distance eastward of Ukulahu is another islet; from this latter islet a chain of reefs extends in a south-south-easterly direction for about

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Chart 66b.

6½ miles to Toroka, the northernmost of the numerous islets which form the eastern side of the atoll.

Anchorage.—Good anchorage was obtained, in 1942, about 2 miles eastward of Matiwari.

Off-lying atoll and island.—Rasdu atoll.—Rasdu atoll, the western extremity of which is situated about 4¼ miles north-eastward of the north-eastern side of Ari atoll, is connected to it by a plateau, with depths of from 100 to 150 fathoms (182^{m}9 to 274^{m}3).

For administrative purposes Rasdu atoll (*Lat. 4° 17′ N., Long. 72° 58′ E.*) is taken as forming part of Ari atoll.

The only openings in the barrier reef are at the southern extremity and at the north-eastern end of the atoll. The southern opening, which is only available for small vessels with local knowledge, lies between Kuramati, an islet about 6½ miles east-north-eastward of Ukulahu, and Rasdu, an islet about three-quarters of a mile eastward of Kuramati. The north-eastern opening, about one mile northward of the northern end of Weligandu, an islet about 2 miles north-north-eastward of Rasdu, has a least depth of 8 fathoms (14^{m}6) in the fairway.

The depths in the lagoon are considerable, but it is encumbered with coral reefs.

Toddu.—Toddu, an island, the southern extremity of which is situated about 5½ miles northward of Rasdu atoll, is fringed by a reef which extends to a distance of about one cable northward, eastward and southward, and about 6 cables westward from it: this reef is steep-to. Toddu was wooded in 1926, and could be seen from a considerable distance; it was reported, in 1934, to be considerably larger than is shown on the chart.

Toddu (*Lat. 4° 26′ N., Long. 72° 57′ E.*) had a population, in 1926, of 432.

Eastern side.—Kadibudu, an islet about 14 miles southward of of Toroka, was uninhabited in 1926. Several islets lie between these two just mentioned, among them being Butala, Eladu, Magari, Fari, Tonagu and Fanaubudu, in that order from north to south.

Midu, about 1¼ miles southward of Kadibudu, is inhabited; there are huts along the western side. There is a landing about the middle of the southern side of the islet abreast the village. There also appears to be a landing place on the western end.

A strong current sets through the channel southward of Midu.

Kuludu Faro, an islet about 1½ miles southward of Midu, was treeless in 1917, and only just above water.

Mahiadu, about 3 miles southward of Kuludu Faro, had, in 1902, high trees on it. The islet of Aumedu lies about midway between them.

Digura, about 13 miles southward of Mahiadu, is the south-easternmost island of the atoll, and was inhabited in 1926. There are a number of other islets situated between them, forming the south-eastern side of the atoll. These include, from north to south, Mafuri, Hurawali, Hitifuri, Kururi and Dugati.

The reef on which Digura stands extends south-westward for about 5½ miles, where its extremity forms one side of the opening on the eastern side of Ariyaddu. Several islets encumber this reef, including Kurafuri and Didu, situated about 1½ and 2½ miles south-westward, respectively, of the south-western extremity of Digura. From its

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Chart 66b.

eastern extremity this reef trends to the north-westward of Digura for a distance of about 2½ miles and encloses a lagoon.

On the eastern side there are numerous passages leading into the lagoon, about one mile apart; some are small, but all are safe if a good look-out be kept. The south-eastern opening, situated northward of Digura, is the widest, being about 2 miles wide.

Channel between Ari atoll and South Male atoll.—The channel between the eastern side of Ari atoll and the western side of South Male atoll is deep, free from dangers and sheltered from the ocean swell.

SOUTH MALE AND MALE ATOLLS.—South Male atoll.—South Male atoll (*Lat. 4° 00′ N., Long. 73° 25′ E.*) contains a number of islets, of which only three were inhabited, with a total population of 888, in 1926.

The islets are nearly all situated along the eastern barrier reef, only three or four being on the western side of the atoll. There are safe passages on one or both sides of all these islets, except the four or five islets at the south-eastern extremity of the group.

The lagoon is deep, but is encumbered with coral reefs, which are, however, easily avoided in a favourable light by a good look-out from the masthead.

Southern, western and northern sides.—At the south-western end of the atoll there is a good channel, half a mile wide, with a least depth of 20 fathoms (36^{m}6) in the fairway, between Rocky islet and the western extremity of the south-eastern barrier reef.

From Rocky islet the barrier reef trends in a northerly direction for about 15 miles to its north-western extremity. Warigili islet, which is remarkable for a bushy sandbank extending from its western side, lies about 7½ miles northward of Rocky islet. Between these two are the islets of Rohi and Runari, which stand on the reef about 4 and 3 miles southward, respectively, of Warigili.

There are several openings through this part of the reef, the widest, which has a sandbank on its southern side, lying about 4 miles northward of Warigili.

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The islet of Bolifuri lies about 2½ miles north-eastward of the north-western extremity of the barrier reef, which curves eastward to about half a mile northward of Huras, an islet standing on its north-eastern corner, about 7 miles eastward of Bolifuri. Almost in the centre of the northern side of the atoll thus formed, lie the islets of Vilas and Wadu.

In 1902, there were some low bushes on Vilas and some coconut trees and low bushes on Wadu; neither of these islands were inhabited in 1926. There are good openings in the reef on either side of Wadu, and between it and Huras there are some sandbanks on the reef.

Eastern side.—Southward of Huras there is a good passage, about one mile wide, with a depth of 11 fathoms (20^{m}1) in the fairway, but in 1917 this channel was reported to be narrower than charted, and should, therefore, be used with caution. Hembudu, an islet about one mile south-westward of Huras, can be passed on either side; Hembudu was uninhabited in 1926.

From the southern side of this opening the eastern side of the atoll trends in a south-south-westerly direction for about 17 miles to its south-eastern extremity; in this length of barrier reef there are a few

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openings and several islets and sandbanks. Of these, Guru, an islet about 6¼ miles southward of Huras, was thickly populated in 1926, and Mafuri, about 2½ miles south-south-westward of Guru, is the largest.

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Midway between Guru and Mafuri, three islets stand on the reef about half a mile apart. On the centre one there are some low bushes, and on those on either side are coconut trees.

A number of uninhabited islets stand on the reef between Mafuri and the south-eastern extremity of the atoll. Among these are Guradu, Madu, Kuda Hura and Haru Hura, situated 2, 4, 5 and 5½ miles south-south-westward, respectively, of the southern extremity of Mafuri. (*Lat. 3° 56′ N., Long. 73° 29′ E.*).

There is dense scrub on Haru Hura and, on an unnamed islet about half a mile south-south-westward of it, there are some low bushes.

On the islet of Hutekolu, about 3 miles south-westward of Haru Hura, there are three trees.

Chart 3324.

Wadu channel.—Tidal streams.—Current.—Wadu channel, between the northern end of South Male atoll and the southern end of Male atoll, 2¼ miles northward, is very deep and free from dangers. There are numerous above-water rocks on the reef on the northern side of the channel.

The tidal streams in the channel are very strong; the flood sets eastward, and the ebb westward. During the monsoons, that stream which is accelerated by the prevailing current attains a rate of 4 knots, and causes strong tide-rips.

In February 1960, H.M.S. *Gambia* experienced a set of 2 knots in a 255° direction in Wadu channel.

Male atoll.—Male atoll, the principal atoll of the Maldive group, contains about fifty islets, several of which are inhabited.

Male and South Male atolls are considered as one atoll for administrative purposes.

The lagoon is deep, with a sandy bottom, but vessels proceeding through the lagoon must keep a good look-out to avoid the numerous coral reefs.

Western side.—Giravaru, an islet on the south-western side of Male atoll, about 4¾ miles north-north-westward of Vilas (page 79), is about half a mile within the outer edge of the barrier reef, and had, in 1902, a clump of tall trees on it; the barrier reef extends about 1¾ miles west-north-westward from it and, in 1945, terminated in a sandy islet about 2 cables long. An islet, about 3 cables in extent, was reported, in 1922, to lie about one mile southward of Giravaru. Another islet lies about 1½ miles westward of Giravaru.

There is a deep opening into the lagoon, close south-eastward of Giravaru.

Northward of Giravaru, between the lagoon-reefs bordering the western side of the atoll, there are several openings into the lagoon; the largest is abreast Hembadu (*Lat. 4° 29′ N., Long. 73° 23′* E.) an islet 16¾ miles northward of Giravaru and about 1½ miles within the edge of the barrier reef.

On the barrier reef, about 5½ miles south-south-westward of Hembadu, is a low islet, on which there were bushes in 1836; the barrier reef in this vicinity was reported, in 1922, to extend further westward

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Chart 3324.

than charted. A sandbank, on which there are some coconut trees, lies inside the reef, about 2¾ miles south-south-eastward of the low islet mentioned above.

The barrier reef, on the northern side of the opening abreast Hembadu, extends northward for about 3¾ miles where it forms the southern side of another opening, abreast the islet of Makunada, which lies about 2½ miles inside the lagoon. There are high coconut trees on this islet from which a reef extends westward for about one mile towards the middle of the opening just mentioned. A 3-fathom (5m5) patch lies about half a mile north-westward of the western extremity of this reef.

On the north-western side of the atoll there are three small, but safe, openings through the barrier reef, one on either side of Akirifuri, an islet, on which there were thick bushes in 1836, situated about 5¼ miles northward of Makunadu; the third opening is about three-quarters of a mile north-eastward of Akirifuri (*Lat. 4° 38′ N., Long. 73° 24′ E.*).

Northern side.—About 5 miles north-eastward of Akirifuri, on the northern edge of the atoll, is a reef, in which is a lagoon; there are openings on either side of the reef both of which have depths of from 22 to 24 fathoms (40m2 to 43m9).

The western opening lies between two sandbanks.

The eastern opening was marked, in 1836, on the western side of its northern entrance by a pile placed on the north-eastern point of this reef; Kagi, an islet about 6 miles east-north-eastward of Akirifuri, lies about 1½ miles within the eastern opening.

Off-lying reef.—About 1½ miles northward of Male atoll and separated from it by a deep channel, free from dangers, is a small atoll, called Gaha Faro reef. At the eastern extremity of this atoll is an islet of the same name, on which there were tall coconut trees in 1836, and which was inhabited in 1926. A clump of trees stands on the barrier reef about one mile west-south-westward of the western extremity of Gaha Faro.

There are two openings into the lagoon, one on the western side of the atoll, about 6¼ miles west-north-westward of the islet just described, and the other on the northern side, about 3 miles north-westward of the same islet; these openings are very small, but above-water rocks mark the eastern side of the northern opening, and apparently the southern side of the western opening.

Eastern side.—From the eastern side of the eastern opening described above, the barrier reef trends in a south-easterly direction for about 5 miles to the low, wooded islet of Helengili and thence, for a further 13½ miles, to Mirufuri, which is wooded. Difuri, a wooded islet about a quarter of a mile southward of Mirufuri, was inhabited in 1926. These two islets, when viewed from a position about 16 miles eastward, often appear as a single island.

Asdu (*Lat. 4° 28′ N., Long. 73° 39′ E.*), an islet situated in the lagoon, about 3 miles westward of Mirufuri, is also wooded.

On the north-eastern side of the atoll there are several large reefs with lagoons in their centres and passages between; there is a deep opening on either side of Helengili; the rest of the openings on the north-eastern side of the atoll have no landmarks to identify them, but a vessel can proceed through them by keeping a good look-out.

Between the northern edge of the reef on which Mirufuri stands and the south-eastern edge of the reef 1¾ miles north-north-westward,

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Chart 3324.

there are two good openings separated by a narrow sandbank; the entrances to these openings may be approached, respectively, with Asdu bearing 226° or 248°. By keeping a good look-out from aloft a vessel can proceed through the lagoon to Male island, about 19 miles south-south-westward of Asdu.

From Mirufuri the barrier reef trends in a south-westerly direction for about 20 miles to Male island.

The reef on which Mirufuri and Difuri stand and in which there is a lagoon, extends in a south-westerly direction for about 6½ miles, and has on its south-western end three islets which had coconut palms on them in 1937, and were prominent; there is an opening between them and Tulusdu, an islet, about half a mile westward, but it is not recommended.

About 2½ and 3½ miles south-westward, respectively, of Tulusdu are the islets of Lohifuri and Hura with an unnamed islet midway between them; about three-quarters of a mile south-south-westward of Hura, are three small islets, on one of which, in 1912, H.M.S. *Proserpine* reported a prominent clump of trees The island of Imma lies about 1¼ miles west-south-westward of the southernmost of these islets

About 1¾ miles west-south-westward of Imma, an unnamed islet, with another low islet lying about half a mile north-north-eastward of it, stands on the northern side of the best and widest opening in the barrier reef, which has depths of from 24 to 28 fathoms (43m9 to 51m2), sand.

The islet of Furena, about 1½ miles farther southward, stands on the reef forming the southern side of the above opening; an islet lies about half a mile north-westward of Furena, with a sandbank situated about the same distance further north-westward. In 1932, two shoals were reported by H.M.S. *Enterprise* to lie about 2 miles north-north-westward of Furena. There are some high coconut trees on the small islet of Farukolu, about one mile southward of Furena (*Lat. 4° 15′ N., Long. 73° 32′ E.*).

Chart 3324, plan of Male anchorage.

Male island.—Dangers.—Breakwaters.—Lights.—Male or Sultan's island, at the southern end of Male atoll, is the capital of the Maldive group, and the residence of the Sultan. There are many trees and houses on the island. In 1956, the population was estimated to be about 8,000.

In 1942, landing could only be effected on the northern side of the island, the remaining coastline being fringed by an unbroken reef, awash and extending up to 2 cables offshore in places, on which there was nearly always a heavy surf. There is a rough breakwater on the southern side of the island, about 6½ cables westward of Wild point, the south-eastern extremity; this breakwater is about 1½ cables long, and close south-westward of its outer end there is a clump of bushes on the reef.

Wilingili, about 80 feet (24m4) high, lies with Rat point, its eastern extremity, about one mile westward of the root of the breakwater on the southern side of Male island. A drying reef, on which the sea breaks, extends about half a cable south-eastward from Rat point and is steep-to. Foul ground extends up to a distance of 3 cables, in places, from the island; rocks, 4 feet (1m2) in height, lie close to the edge of the reef extending from the south-western side of the island, about half a mile south-westward of Rat point; this foul ground is steep-to. The wooded

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Chart 3324, plan of Male anchorage.

islet about 1½ cables westward of the north-western extremity of Wilingili island was reported, in 1945, to be devoid of all vegetation.

The area between Male and Wilingili is unsurveyed. Two patches, with depths of 4 and 5 fathoms (7m3 and 9m1), lie about half a mile south-eastward of Rat point. There are tide-rips in this vicinity.

Hulele island, situated about 7 cables eastward of the northern end of Male island, was covered with coconut palms, in 1937, and conspicuous.

Keane island, close southward of Hulele island, is small, but, in 1937, was covered with bright green shrubs, and easily identified.

Funidu island lies about 8 cables northward of Wild point.

Along the northern side of Male island (*Lat. 4° 10′ N., Long. 73° 30′ E.*) there was, in 1942, an artificial breakwater, consisting of heaped coral, about 4 feet (1m2) high and from 6 to 8 feet (1m8 to 2m4) wide; this breakwater, which is from about a quarter of a cable to one cable offshore, forms a sheltered harbour for native boats. The depths in this harbour are from 3 to 6 feet (0m9 to 1m8), and the entrance, about 40 feet (12m2) wide, was, in 1942, abreast the town pier, which is situated about 7 cables north-westward of Wild point.

A light is exhibited, at an elevation of 15 feet (4m6), from the breakwater on each side of the entrance.

In 1942, there was a depth of about 12 feet (3m7) in the vicinity of the town pier.

Landmarks.—Beacon.—The Sultana's tomb, on the south-eastern point of Male island, and some forts on the north-eastern point, are good landmarks; the Sultana's tomb consists of a square whitewashed building, with two small towers surmounted by lamps and resembling miniature lighthouses. It has also a mast, from which several pieces of white cloth are usually flown; a high white wall, which is prominent, extends from the tomb around the eastern side of the island. The Sultan's palace, about 1½ cables south-south-westward of the town pier, has a peaked roof, and stands in a walled enclosure.

A white beacon raised on piles, stands on the reef extending from the western side of Hulele island, about 4 cables south-south-westward of the northern extremity of the island.

Anchorages.—Mooring buoys.—Large vessels can obtain anchorage about 6 cables northward of the pier in depths of from 23 to 24 fathoms (42m1 to 43m9).

Small vessels can secure to anchors on the reef on the eastern side of Dunidu island, about 8 cables northward of the northern end of Funidu island, with stern anchors laid out in an easterly direction.

During the south-west monsoon small vessels can also moor on the eastern side of a reef, in which is a lagoon, situated about 8 cables north-westward of the northern extremity of Dunidu island. On the edge of this reef, which dries, are several anchors, to which vessels make fast, with stern anchors laid out in an easterly direction.

In 1942, a spherical mooring buoy was moored eastward of a small pier on Dunidu island, and a can mooring buoy in the south-western corner of the lagoon close north-north-eastward of Huele island.

Tidal streams.—The tidal streams set in an easterly direction with the flood tide past the southern side of Male island, and in a westerly direction with the ebb; they are very strong when accelerated by the current, and are reported to set strongly across the southern entrance

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Chart 3324, plan of Male anchorage.

to the channel eastward of Male island (*Lat. 4° 10′ N., Long. 73° 30′ E.*). The cross set is lost as soon as a vessel enters the channel eastward of Male island.

In 1931, H.M.S. *Enterprise* stated that strong tidal streams, mostly setting in a westerly direction, and causing heavy ripples, were almost continuously observed from the 5th to the 8th of March in the area within a distance of 4 cables from Male pier. H.M.S. *Enterprise* took anchorage outside this area, as did a number of sailing vessels gathered at the anchorage. These conditions were also observed by H.M.S. *Loch Quoich* early in May, 1951; when anchored about 6 cables northward of the pier, in a depth of about 24 fathoms (43^{m}9), no stream was found there.

The ebb tide running northward of Funidu sets onto Hulele and causes disturbed water within about 6 cables west-north-westward and off the south-east side of Funidu.

Directions.—The channel on the eastern side of Male island was used by H.M.S. *Emerald*, in 1935, and is recommended. The fairway is about 4½ cables wide between the reefs, which extend for about 1½ cables from both the eastern side of Male and the western side of Keane island, respectively.

The following directions for making the channel eastward of Male island were given in 1958:—

From southward a vessel should approach with the eastern tangent of Dunidu bearing 338°, open eastward of Funidu, and keep it so until the southern tangent of Keane island bears 068°, when she should steer 350°, which leads through in mid-channel.

The outline of the reefs around the islands in very distinct.

The passage on the western side of Male is unsurveyed and should not be used.

Charts 3324, plan of Male anchorage; 3324, 66a, 66b.

A vessel approaching Male island from the westward should enter Kardiva channel, the channel northward of Male atoll, between Toddu (page 78) and Horsburgh atoll, about 25 miles northward, passing fairly close northward of Toddu, and from thence she should steer south-eastward for Wadu channel (page 80); Toddu and Male island are both visible for a considerable distance, and the former will probably not be out of sight before the latter is sighted. Male anchorage can then be steered for, passing eastward of Male island (*Lat. 4° 10′ N. Long. 73° 30′ E.*) as directed above.

Chart 3324, with plan of Male anchorage.

For vessels coming from the eastward, the wide opening about 5½ miles north-eastward of Male island provides ready access into the lagoon. Vessels using this channel are advised to round the sandbank north-westward of Furena before bearing south for Male anchorage. Though this wide opening was formerly recommended for sailing vessels from the eastward, the southern entrance eastward of Male island, for which recent directions are given above, is to be preferred.

Chart 3324, plan of Male anchorage.

Supplies.—In 1942, spring water was plentiful, but too brackish for drinking, rain water being collected for this purpose.

Coconuts, pawpaws, breadfruit and bananas were grown on the island and fish was plentiful.

Trade.—The principal exports to Ceylon are maldive (dry) fish,

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Chart 3244, plan of Male Anchorage

copra, tortoise-shell, cowries, shells and coir. The principal imports are rice, sugar, cotton, dyed and piece goods, areca, kerosene oil and wearing apparel.

The port is visisted continually by Indian trading vessels, from 60 to 90 vessels calling from time to time throughout the year.

The islanders in the other atolls are not allowed to trade with foreign vessels; trade must be carried on at Male only.

Communications.—There is irregular communication with Colombo by buggalows belonging to Indian merchants. The passage takes about three days during the favourable monsoon, and thirty days or more during the unfavourable.

Charts 3324, 66a, 66b.

KARDIVA CHANNEL.—Kardiva channel, between Ari and Male atolls, south-eastward, and South Malosmadulu and Fadiffolu atolls, north-westward, is a deep channel, free from dangers in the fairway.

Horsburgh atoll lies about 6 miles southward of the southern extremity of South Malosmadulu atoll.

Landmarks.—Toddu is a good landmark for the western approach to Kardiva channel, and Kardiva (*Lat. 4° 58′ N., Long. 73° 27′ E.*), also known as Karidu, an island about 11½ miles northward of the northern extremity of Gaha Faro reef, is a good landmark for the eastern approach.

The western entrance of Kardiva channel is not easily identified, as the islets, on which there are trees, in Ari and Horsburgh atolls, lie from 4 to 5 miles within the prominent points of their barrier reefs.

Chart 3324.

Gaha Faro reef stands on the southern side of the eastern entrance to this channel, but has no landmarks on its northern and western sides. The northern side of the eastern entrance is, however, well defined by Olivelifuri, an island at the south-eastern end of Fadiffolu atoll which, in 1836, had a tall clump of trees on it, and which lies about 19½ miles north-north-eastward of Kardiva.

Caution.—The width of the channel between Kardiva island and Gaha Faro reef was reported, in 1957, to be about 2 miles less than is shown on the chart.

Tidal streams.—The tidal streams set in an east-north-easterly direction through Kardiva channel with the flood tide, and in a west-south-westerly direction with the ebb, at a rate of 2 knots.

During the north-east monsoon, the tidal stream is inappreciable during the flood tide, but the rate of the stream during the ebb is considerably increased by the strong current setting in the same direction as the wind. During the south-west monsoon the flood stream is strong, with no appreciable ebb stream.

Chart 2036.

HORSBURGH ATOLL.—Beacons.—Horsburgh atoll (*Lat. 4° 52′ N., Long. 72° 55′ E.*) is a small atoll lying on the northern side of the western entrance ot Kardiva channel. For administrative purposes it is considered as part of South Malosmadulu atoll.

Goidu, at the north-eastern extremity of the atoll, is the largest of its islands, and was inhabited in 1945; the seaward face of this island was thickly wooded in 1934. There is a conspicuous banyan tree, 117

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Chart 2036.

feet (35m7) high, about midway along the northern side of the island. Two beacons, a short distance apart, are situated on the northern edge of the reef about one quarter of a mile north-north-westward of the banyan tree; in 1945, they were reported to mark a boat channel; there is a rough pier between the eastern beacon and the banyan tree.

Fehendu and Furudu, about one and 3 miles westward, respectively, of Goidu, were also inhabited in 1945. Fehendu, 97 feet (29m6) high to the tops of the trees at its eastern end, was thickly wooded in 1934; Furudu, 86 feet (26m2) high to the tops of the trees on its eastern part, was, in the same year, fairly thickly wooded, especially in its eastern part, where there were several large trees. The western part of this island was, however, mainly covered with scrub; there is a conspicuous palm tree, 57 feet (17m4) high, at its western end, visible from nearly all directions, but it cannot be seen from The Dorukandu (*see* below). Furudu was reported, in 1945, to have extended westward and the cays between it and Inafuri to be more numerous than charted. The villages on the northern sides of Fehendu and Furudu are visible from seaward.

The islet of Inafuri, 48 feet (14m6) high and bushy, lies on the barrier reef, about 2½ miles westward of the western extremity of Furudu.

The islets of Mafuri and Fehenfuri, both of which were uninhabited in 1945, lie on the southern side of the barrier reef about 4 miles south-south-eastward of Inafuri.

Lagoon.—Anchorage.—The lagoon is free from dangers in the centre, but there are many near the barrier reef.

Good anchorage can be obtained in the lagoon in depths of from 15 to 23 fathoms (27m4 to 42m1), sand, mud and clay.

Opening.—Dangers.—Caution.—The only opening into the lagoon lies near the south-western corner of the atoll between Mafuri islet and Fehenfuri islet.

The channel through this opening, known as The Dorukandu, lies on the western side of the opening between the barrier reef, and the shoal ground which extends about 7 cables westward from the reef on which Fehenfuri stands; it is about one cable wide at its narrowest part and has a least depth of 10 fathoms (18m3). The eastern extremity of Fehendu islet, bearing 052°, leads from south-westward towards this opening.

Eastward of The Dorukandu the depths in the opening are shoal and irregular. A 14-foot (4m3) patch lies near the edge of The Dorukandu about 3 cables eastward of Mafuri islet; another patch, with a least depth of 16 feet (4m9), lies about 9 cables east-north-eastward of the same islet.

Two 10-fathom (18m3) shoals are situated about one mile and 1¼ miles north-north-eastward of Mafuri islet (*Lat. 4° 49′ N., Long. 72° 53′ E.*).

Vessels are cautioned not to attempt to enter the lagoon except through The Dorukandu; conning from aloft is advisable.

Chart 3324.

Kardiva.—Kardiva was, in 1836, thickly covered with tall coconut trees, and, in 1926, was inhabited; its south-eastern side is steep-to.

On its northern side there is a reef, enclosing a lagoon, in which the natives moor their boats. The entrance into the lagoon is about half a mile north-westward of the north-eastern point of the island; landing

Charts 66a, 827, 748b.

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Chart 3324.
can only be effected on Kardiva by entering the lagoon, as there is generally a heavy surf round this island and reef, except at the lagoon entrance.

Chart 66a.

MALOSMADULU AND FADIFFOLU ATOLLS.—Malosmadulu atolls, consisting of South Malosmadulu atoll and North Malosmadulu atoll (*Lat. 5° 30′ N., Long. 73° 00′ E.*), about 2 miles northward, are divided by Moresby channel, which can be used by vessels desiring to pass between the two atolls.

Vessels can obtain temporary anchorage at the southern end of the southern atoll (*see* page 88). The navigation of the central part of the northern atoll is impracticable, on account of the numerous coral reefs.

South Malosmadulu atoll.—South Malosmadulu atoll had a population, in 1926 of 3,367; the principal occupation of the inhabitants is cloth weaving.

Southern and western sides.—Olugeri, the southernmost islet of the atoll, is situated about 7 miles northward of Furudu (*see* Horsburgh atoll). There is a wide opening, into the lagoon, on the western side of Olugeri, in which, however, there is a rocky shoal, with a charted depth of 7 fathoms (12m8) over it. The islands of Hitadu and Maduwari lie about one mile and 1½ miles eastward, respectively, of Olugeri.

In 1940, there was a medium-sized village on Hitadu island.

On the reef which forms the western side of the opening just mentioned stand the islets of Boduffnur, Turadu and Velengili, about 2¾ miles westward, 3¾ miles west-north-westward and 5 miles north-westward, respectively, of Olugeri.

About 9½ miles north-north-eastward of Velengili lies the south-western extremity of a detached reef, enclosing a lagoon, and known as Kari Faro. Mawa Faro and Defili Faro, two other detached reefs, also enclosing separate lagoons, lie between these two points and form the central part of the western side of the atoll.

The islets of Iwafuri and Fahris (*Lat. 5° 15′ N., Long. 72° 51′ E.*) are situated at the south-western and south-eastern corners, respectively, of Kari Faro. Inside the main lagoon, about 1¼ miles north-eastward of Fahris, lies the island of Dukandu, with the reef, enclosing a lagoon, of Hanikandu Faro lying close northward and extending westward to form the north-western corner of the atoll.

There are several openings on the western side of South Malosmadulu atoll, but the lack of convenient landmarks makes their extremities difficult to define.

The opening between Hanikandu Faro and Medu Faro, another detached reef, enclosing a separate lagoon, situated about 1¼ miles north-eastward, gives way to an approximately east and west passage through the atoll on the respective boundaries of which are a number of islets and reefs, enclosing lagoons.

Northern side.—The northern side of the atoll, which also forms the southern boundary of Moresby channel (*see* below), is formed by several islets and detached reefs, enclosing separate lagoons, known as, from west to east, Medu Faro (already mentioned), Marar, Anghenufuri, Gaha, Dhigfuri and Gawa Faro.

Moresby channel.—Moresby channel is about 2 miles wide, with

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Chart 66a.

depths of over 100 fathoms (182m9) and free from dangers. At the time of the survey in 1836, the entrances to this channel were difficult to identify, as there were no islets with trees on them but only barrier reefs.

Eastern side.—From the south-eastern extremity of Gawa Faro the barrier reef trends south-south-eastward for about 3½ miles to the southern extremity of a detached reef, which stands at the north-eastern corner of the east and west passage through the atoll, described above. On the southern boundary of this opening is another detached reef with the islet of Sudaroa situated close to its eastern extremity; Sandy islet lies on the reef close westward of Sudaroa (*Lat. 5° 18′ N., Long. 73° 05′ E.*).

The island of Kumadu lies about one mile eastward of Sudaroa. Mabaru island lies about 4½ miles south-eastward of Kumadu, the intervening reefs and unnamed islets forming, with those northward of the passage opening, the north-eastern corner of the atoll.

Situated about 5¾ miles south-westward of Mabaru is the islet of Duravandu, which had, in 1926, a population of 383. Between these two islets lie the reefs, enclosing separate lagoons, of Wandu Faro and Huni Faro, the former being the northernmost, with the islet of Aidu about midway between them.

The islet of Hebaridu lies about 1¼ miles south-westward of Duravandu, with a smaller islet close south-westward of it known as Mahrus. About 1¾ miles south-westward of Mahrus is the islet of Kumfinadu, with a small reef-encircled islet lying about three-quarters of a mile north-eastward of it.

Hedufuri, Madu, Madufuri, Meriadu, Mafuri and Kanifuri lie, in that order, in a general line south-westward from Kumfinadu, forming, with Maduwari, mentioned above, the southern half of the eastern side of the atoll.

Openings.—There are numerous openings into the main lagoon between the reefs and islets on both northern and eastern sides of the atoll.

Anchorage.—Anchorage can be obtained off the northern side of Hitadu (page 87), situated at the south-eastern extremity of the atoll.

North Malosmadulu atoll.—North Malosmadulu atoll is similar in character to South Malosmadulu atoll, having its western side composed of a series of reefs embracing lagoons, some prominent, others farther in the background, which is a peculiar feature of the northern atolls of the Maldive group. The total population of the atoll, in 1926, was 4,426.

The eastern side of the atoll consists of about twenty islands and islets, between which there are good passages leading into the lagoon.

Western and northern sides.—The south-western corner of the atoll is formed by the following reefs, enclosing separate lagoons:—Mamanaga Faro, Femfuri Faro and Ma Faro, which are situated about 2 miles north-westward, 4¾ miles north-north-westward, and 6¾ miles northward, respectively, of the western extremity of Medu Faro (*Lat. 5° 19′ N., Long. 72° 53′ E.*). Kukuludi Faro reef lies about 1¼ miles north-north-westward of Ma Faro, with the islet of Maregiri about one mile north-north-westward of its northern extremity.

For about 24 miles north-north-eastward of Maregiri, to the northern

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Chart 66a.

extremity of Maduni Faro reef, the barrier reef consists of a series of similar lagoon-enclosing reefs, some of which have small unnamed islets on them. These reefs, in order northward from Maregiri, are known as Bodu Faro, Dina Faro, Telin Faro, Wa Faro, Kuda Faro, Ma Faro (not to be confused with the reef of the same name mentioned above), Eugiri Faro, Ekuru Faro, Kandu Gandu and Digu Faro.

These lagoon-enclosing reefs are difficult to identify, due to the absence of above-water features, and the channels between them are better avoided, especially as no vessel could navigate with safety through the lagoon in the centre of the atoll.

The island of Wadu, about 3 miles east-south-eastward of Maduni Faro, stands at the southern end of a reef-enclosing lagoon, which has a low stony islet at its northern extremity and which forms the north-eastern extremity of the atoll.

Between Maduni Faro and Wadu there is a wide opening into the lagoon, free from dangers in the centre of the fairway, with depths of 20 to 24 fathoms (36m6 to 43m9), sand.

There are some rocks about 3 miles north-north-westward of Wadu.

Powell islands.—Powell islands lie about 3 miles northward of the northern extremity of the atoll and about 6 miles north-north-westward of Wadu. They consist of two islands, Etingili and Alifuri, on a detached reef, with surrounding depths of over 100 fathoms (182m9) in places. The southern island, which was inhabited in 1926, is known as Alifuri and the northern one is called Etingili (*Lat. 5° 59′ N., Long. 72° 55′ E.*).

These islands are separated from the atoll by a channel, free from known dangers.

Anchorage.—Between Maduni Faro and Wadu good anchorage may be obtained either in the channel or farther southward in the lagoon.

Eastern side.—From Wadu the barrier reef trends south-south-eastward for about 12½ miles to Duwafuri. The islets and islands of Raskatin, Anguretin, Furidu, Hundudu, Hurudu, Hefuri, Ongulu and Ongu lie between Wadu and Duwafuri, their northern extremities being about 2, 2¾, 4¼, 5½, 6, 7¾, 9, and 10¼ miles south-south-eastward, respectively, from the southern extremity of Wadu.

From Duwafuri the barrier reef extends southward for about 11 miles to the north-eastern extremity of the lagoon-enclosing reef of Berriam Faro. The islets and islands which stand on this south-eastern portion of the reef are named Makura, Kuda Kura, Rasmadu, Inamadu, Wandu, Kotafuri, Inguradu, Fainu, and Kenurus; their northern extremities lie about half a mile, 2, 3, 4, 4¾, 6¼, 8¼, 9, and 9¾ miles, respectively, from the southern extremity of Duwafuri (*Lat. 5° 38′ N., Long. 73° 01′ E.*).

Southern side.—From the south-western extremity of Berriam Faro, mentioned above, the barrier reef extends south-westward for about 11 miles to the western extremity of Mamanaga Faro and forms the southern side of the atoll and also the northern boundary of Moresby channel (page 87).

The islets of Wadu (which should not be confused with the island of the same name which lies in the north-eastern corner of the atoll), Furuwari, Velengili (which should not be confused with the islet of the same name in the south-west corner of South Malosmadulu atoll), and Mamnaga lie on this section of the reef, about 1½, 2¼, 4, and 6½ miles

Charts 827, 748b.

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Chart 66a.

south-westward, respectively, of the south-western extremity of Berriam Faro.

Chart 3324.

Fadiffolu atoll.—Fadiffolu atoll contains upwards of twenty islets, but only four are inhabited. The total population, in 1926, was 3,592. The principal occupations of the inhabitants is sail weaving and coir making.

There are moderate depths in the lagoon, and a sandy bottom. In the lagoon are many coral reefs, which dry, and several sunken reefs, with depths of from one to 2 fathoms (1m8 to 3m7) over them.

Western side.—Aligau, the southernmost islet of the atoll, about 16½ miles northward of Kardiva (page 86), was, in 1926, uninhabited, and about a quarter of a mile north-westward of it, and between it and the islet of Lowalafuri, about 3½ miles north-north-westward, there is a wide opening through the barrier reef.

The islet of Kanifuri (*Lat. 5° 22′ N., Long. 73° 20′ E.*) stands at the western end of the barrier reef where it projects sharply to form the western extremity of the atoll, about 9 miles west-north-westward of Lowalafuri. On the eastern end of this projecting reef is a group of low islets known as Dehu.

Between Lowalafuri and Dehu, the barrier reef extends in a general north-westerly direction and encloses the islets of Lohi, Kurangdu, Maro and Mafilefuri, about half a mile and 1¼ miles north-north-westward, and 3½ and 4 miles north-westward, respectively, of the north-western extremity of Lowalafuri. There are openings into the lagoon on either sides of the above-named islets except between Maro and Mafilefuri.

From Kanifuri, the barrier reef extends north-north-eastward for about 6 miles to about half a mile northward of the islet of Madewaru. The islets of Naifaro (the most densely populated in the atoll in 1926), and Vawaru are situated on this portion of the reef about half a mile and 2 miles south-south-westward, respectively, from the southern extremity of Madewaru; a detached reef, on which stands an unnamed islet, lies midway between them.

From Madewaru the barrier reef trends in a general north-easterly direction for about 7¾ miles to the islet of Kuredu, which stands on a detached portion of the reef at its north-eastern extremity; the islet of Hurawali is situated at the southern end of this detached reef where it projects westward, about 1½ miles south-westward of the south-western extremity of Kuredu (*Lat. 5° 33′ N., Long. 73° 28′ E.*).

The islets of Fallwaru, Inawari, Komandu and Kudadu are situated about half a mile, 2½, 3½ and 5 miles north-eastward, respectively, from Madewaru. These islets lie some distance inside the enclosing reef, especially Komandu and Kudadu, which are about three-quarters of a mile eastward, respectively, of its western extremity.

There are several channels leading into the lagoon between the islets in this section of the atoll.

Between Kuredu and Fehingili, an islet, which was uninhabited in 1926, about three-quarters of a mile eastward of Kuredu, there is an opening into the lagoon, with moderate depths in it, but about three-quarters of a mile within this opening some reefs lie in the fairway.

Eastern side.—From Fehingili the barrier reef curves southward

Charts 827, 748b.

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Chart 3324.

for about 3 miles where its southern extremity forms one side of the northernmost opening in the north-east corner of the atoll; a number of islets stand on this reef, the southernmost of which is known as Kani Hura, and lies about 1¾ miles south-eastward of Fehingili.

Furifaro, an islet with a rocky shoal close north-westward of it, lies on a reef in the centre of this northernmost opening, the southern side of which is formed by the extremity of the reef extending north-westward from the islet of Guradu, about 2½ miles farther south-eastward.

The islet of Difuri (*Lat. 5° 25′ N., Long. 73° 39′ E.*) stands close to the eastern extremity of the atoll, about 6 miles south-eastward of the south-eastern extremity of Guradu. Of the islets lying between these two, Faidu is about 3 miles south-eastward of Guradu.

From Difuri the barrier reef extends southward for about 5 miles to the islet of Maben, thence it trends south-south-westward for about 4 miles, to about half a mile southward of the island of Olivelifuri, whence it extends south-westward for about 6¼ miles to Aligau. Olivelifuri was inhabited in 1951.

There are no openings in the barrier reef between Difuri and Aligau and it has several other islets on it. Of these the only ones named are Hudufuri, about 2½ miles southward of Difuri, Tiliamafuri and Farfunoli, situated between Olivelifuri and Aligau, about 4½ and 2¾ miles north-eastward, respectively, of the latter islet.

During the north-east monsoon the sea breaks with considerable violence along this unbroken line of barrier reef. At low water large masses of coral rock and some sandbanks can be observed on its seaward face.

Tidal streams.—The tidal streams set strongly through the openings into the lagoon.

Chart 66a.

MILADUMMADULU AND TILADUMMATI ATOLLS.—Miladummadulu atoll.—Miladummadulu atoll, separated from the north-eastern end of North Malosmadulu atoll by a channel about 7 miles wide, and from the northern end of Fadiffolu atoll by a channel about 9 miles wide, although geographically one atoll, are, for administrative purposes, considered as two separate atolls, the southern part being known as South Miladummadulu atoll, and the northern part as North Miladummadulu atoll.

Miladummadulu atoll contains about 100 islands and islets, which are situated principally in the south-eastern and eastern parts.

Sixteen of the islands and islets belonging to South Miladummadulu were inhabited, in 1926, with a total population of 4,519. The principal occupation of the inhabitants is basket making.

A vessel can easily navigate the lagoon in daylight, if she is conned from aloft, as there are few dangers, especially in the northern part. The depths in the lagoon are moderate, the bottom being sand, with clay in places.

Western and southern sides.—The islet of Kandudu (*Lat. 5° 39′ N., Long. 72° 16′ E.*) lies at the south-western corner of the atoll, with Karema, the only other islet on the southern boundary, situated about 1¼ miles eastward from its eastern extremity.

Between Kandudu and the island of Mavila, about 12 miles north-north-westward, lie the islets of Rafuri, Watedu, Tarburudu, Didu and

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Chart 66a.

Fadu, situated about 1¼, 2¾, 4¾, 5½ and 7¼ miles north-north-westward, respectively, of Kandudu.

There are some bushes on Tarburudu, and about half a mile north-north-westward of Fadu is an unnamed lagoon-enclosing reef.

From Mavila the barrier reef extends northward for about 10¼ miles to an unnamed islet standing on the extremity of a reef, enclosing a lagoon, known as Kuda Faro, with the islet of Guradu lying close south-eastward.

About 3½ miles northward of Mavila is the island of Makaradu, with an unnamed reef, enclosing a lagoon, about half a mile southward and another called Digu Faro about 1½ miles northward of it. There is a 3-fathom (5^{m}5) patch close northward of Digu Faro, with a small reef-fringed islet close north-westward; a small islet, on which there is a clump of trees, stands on the reef near the southern extremity of Digu Faro.

From the north-western corner of Kuda Faro the barrier reef trends north-westward for about 6¼ miles to the western extremity of a detached reef, on which stand two unnamed islets. Midway between these two points are some banks of sand and coral rock, close to the south-eastern extremity of which lies the islet of Nakawendu, on which there is a clump of trees; at the north-eastern corner of these banks stands the island of Kumandu.

About 4½ miles northward of the reef, on which there are two unnamed islets, mentioned above, is a reef, enclosing a large sandbank, marked on the chart as "Tree sand Bank." Midway between these two reefs is another lagoon-enclosing reef, on the eastern side of which stands a bushy islet.

"Tree sand Bank" extends about 2½ miles eastward into the lagoon and has a small islet on it near the centre. About half a mile southward of "Tree sand Bank" and almost midway between it and the bushy islet, mentioned above, is another small, isolated sandbank.

From "Tree sand Bank" to the north-western extremity of the atoll, about 22 miles farther north-north-westward, the barrier reef consists almost wholly of reefs, embracing separate lagoons, some of which have islets or sandbanks on them. Of these Kofenbe and Bilifuri, situated about 8 and 11 miles northward, respectively, of the western extremity of "Tree sand Bank", are the only ones named.

The island of Kubudu lies about 2½ miles within the lagoon and about the same distance northward of the central islet on "Tree sand Bank."

There are several wide and safe openings into the lagoon on this western side of the atoll.

Goadu.—The island of Goadu (*Lat. 6° 25′ N., Long. 72° 55′ E.*), about 5½ miles north-north-westward of Bilifuri, had a population of 67 in 1926. There were, in 1917, coconut trees on the north-western part of the island, and on other parts bread-fruit, banyan and other trees.

The main village is situated in the centre of the island. The natives were found to be smaller than those inhabiting the northern atolls of Maldive and Laccadive islands and were of a suspicious nature.

Kandute.—The island of Kandute, approximately the same size as Goadu and situated about half a mile north-north-westward, was uninhabited in 1926. Landing can apparently be made anywhere along the south-eastern side of the island; the fringing reef here has depths of

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Chart 66a.

from 4 to 6 feet (1m2 to 1m8) over it. Within the reef there is a deeper channel, about 12 feet (3m7) wide, running by the shore.

Off-lying atoll.—Makunudu atoll, also known as Malcolm atoll, the north-eastern extremity of which is situated about 12½ miles westward of Goadu, is a reef, embracing a lagoon which, though deep, is encumbered with coral reefs. There are two openings on its eastern side which, however, can only be used by boats.

The north-eastern point of this small atoll is well defined by the island of Makunudu, but the southern and western sides have only the surf, and an islet at the north-western extremity, to indicate their outline.

For administrative purposes Makunudu atoll is included in Miladummati atoll.

Faro Doru, on the eastern side of the atoll, about 5¾ miles southwestward of Makunudu, was, in 1835, covered with high bushes.

In 1926, Makunudu island had a population of 200.

Northern and eastern sides.—Anchorage.—There are no islets or reefs lying on the boundary between Miladummadulu and Miladummati atolls which is indicated on the chart.

The island of Numara (*Lat. 6° 26′ N., Long. 73° 03′ E.*), with the islet of Nu lying close north-north-westward of it, is situated about 7½ miles eastward of Goadu and stands at the north-eastern corner of the atoll.

Fivaku, an island on which there are some high trees, lies about 9 miles south-eastward of Numara; between these two islands is a very wide opening into the lagoon. The island of Faidu, which is situated about 4 miles inside the lagoon abreast the centre of this opening, had a population of 255 in 1926.

From Fivaku the barrier reef trends south-south-eastward for about 13 miles to the southern extremity of a detached reef, on which stands the island of Funadu. About 1½ miles northward of this latter island, and situated at the northern extremity of the same reef, is Farukolu with a smaller islet close southward of it.

Between Fivaku and Farukolu are the islands of Nalandu, Milandu and Makandudu, with wide, deep openings into the lagoon on either side of each of them.

In 1926, Makandudu had a population of 553.

From the southern extremity of Furnadu the barrier reef extends southward for about 8½ miles to the horse-shoe shaped islet of Bodu Mandu. The islets of Ereadu, Ekasdu, Maungudu and Kudu Mandu lie between these two points, about 2, 4, 6, and 7¼ miles southward, respectively, of Furnadu.

For about 6¾ miles east-south-eastward of Bodu Mandu the barrier reef trends in this general direction as far as the island of Kuludu, which is of a considerable size and embraces two separate lagoons. The islets of Kalaidu, Bomasdu, Breyfasdu, Komandu and Hainbudu lie on this section of the barrier reef, on an approximate curve from south-eastward to east-south-eastward, about 1¼, 2½, 4, 5 and 5½ miles, respectively, from Bodu Mandu.

Kendikolu, an islet situated near the southern extremity of Kuludu, affords anchorage to vessels with local knowledge, westward of its southern point. The passage into the lagoon, southward of this islet, is wide and safe.

From Kendikolu the barrier reef extends south-south-eastward for

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Chart 66a.

about 6¾ miles to the eastern extremity of a reef, enclosing a lagoon, known as Ma Faro. Almost midway between these two points is the islet of Malandu, with those of Tolandu and Landu (*Lat. 5° 53′ N., Long. 73° 27′ E.*) about one mile equidistant on either side, north-north-westward and south-south-eastward, respectively.

From the southern extremity of Ma Faro the barrier reef trends south-south-westward for about 8 miles to the southern extremity of another reef, enclosing a lagoon, known as Edu Faro, and from thence south-westward for about 5 miles to the islet of Karema, thus forming the south-eastern corner of the atoll.

Inside the lagoon, in this vicinity, lie the three most densely populated islands in the southern part of the atoll, namely:—Manadu (564), Miladu (814) and Huludu (772), which are situated about 1¼ miles northward, 4 miles north-north-westward and 8¼ miles westward, respectively, of the northern extremity of Edu Faro.

Manadu.—Anchorage.—Manadu, mentioned above, is covered by a profusion of coconut palms, banyan trees, bread-fruit and almond trees; the village is situated about one cable from the eastern extremity of the island.

Good anchorage can be obtained by vessels with local knowledge on either the northern or southern sides of Manadu, according to the season.

A boat channel passes through the reef, which extends the whole length of the northern side of the island, to abreast the centre of the village. The passage is narrow, about 6 feet (1^{m}8) deep and fringed by large boulders of coral rock. Within the reef is a deep channel skirting the beach, and from 20 to 30 yards (18^{m}3 to 27^{m}4) wide.

Tidal streams.—The tidal streams at Miladummadulu atoll set in an east-north-easterly direction with the flood tide, and in a west-south-westerly direction with the ebb, attaining a rate of from 1½ to 2 knots at springs; the currents influence the streams greatly.

Tiladummati atoll.—Tiladummati atoll (*Lat. 6° 40′ N., Long. 73° 00′ E.*) is a continuation of, and stands on the same subterranean plateau as Miladummadulu atoll; the boundary line follows about the parallel of lat. 6° 29′ N. and is indicated on the chart. There are about forty islands and islets in this atoll, generally of a larger size than those already described in this volume, and they lie some distance apart. The islands in the north-eastern part of the atoll are the largest and are inhabited, there being a total population, in 1926 of 10,108.

Western side.—There are not so many islets on the western side of Tiladummati atoll as on the eastern, but the reefs are more numerous; although there are navigable passages through the barrier reef on the western side of the atoll they are better avoided.

There are safe passages into the lagoon on the eastern side of the atoll; they can be navigated if the vessel is conned from aloft.

From the parallel of lat. 6° 29′ N. the barrier reef trends northward for about 8½ miles to an unnamed detached reef, with a lagoon on its eastern side, and thence for about 2½ miles north-north-eastward to another detached reef, enclosing the island of Naguri.

In the wide opening at the southern end of this portion of the atoll there is an extensive rocky patch, extending for about 2 miles northward of the boundary line; this dangerous patch also extends eastward for about 2½ miles into the lagoon. About three-quarters of a mile northward of the northern edge of this rocky patch there is a circular,

Charts 827, 748b.

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Chart 66a.

detached reef, enclosing a lagoon, with the islet of Muradu situated on its eastern extremity; an unnamed islet stands on this same reef about three-quarters of a mile westward of Muradu.

Midway between this circular reef and the detached reef, mentioned above, about 3¾ miles farther northward there is another, unnamed triangular-shaped reef, enclosing a lagoon.

From the western extremity of the reef enclosing the island of Naguri (*Lat. 6° 40′ N., Long. 72° 53′ E.*), the barrier reef trends north-north-eastward for about 12½ miles to the northern extremity of Maduni Faro, a reef, enclosing a lagoon, which stands at the north-western corner of the atoll. The islet of Kanamano lies on this section of the atoll, about 1½ miles northward of the north-western extremity of Naguri.

About 2½ miles north-eastward of Kanamano, the island of Nawadu stands at the south-eastern corner of a detached reef, with the islet of Rafuri about half a mile north-north-eastward on the same reef; an unnamed islet is situated on the reef midway between them.

There is an opening into the lagoon about 4 miles wide between Rafuri and the southern extremity of Maduni Faro.

Caution.—It was reported, in 1940, by a ship which visited the northern end of Tiladummati atoll in that year, that the general contour of the atoll, as charted from the 1835 survey, was approximately correct, but that individual islands differed considerably from their charted positions. Some features, originally chartered as reefs, were found to be dry at high water and covered with vegetation and, in some cases, palm trees. As the description herein is based on the original survey, mariners are warned accordingly.

Northern side.—From the northern extremity of Maduni Faro the barrier reef trends east-south-eastward for about 5¼ miles to the islet of Gafuri, close westward of which lies an unnamed reef enclosing a small lagoon.

The islets of Miledu, Tukandu and Marandu, the two latter of which are reported to contain deep lagoons, are situated about 2, 3 and 4 miles westward, respectively, of Gafuri.

From Gafuri the barrier reef extends in a general north-easterly direction for about 12½ miles to close northward of Kelai, an island which stands at the north-eastern extremity of the atoll, and forms a prominent mark. It is, however, low, like the remainder of the islands and islets. Mango trees abounded there in 1926.

Between Gafuri and Kelai (*Lat. 6° 58′ N., Long. 73° 12′ E.*) lie an unnamed reef enclosing a lagoon, the island of Dedu, Warra-Furra-Fhur reef and the islet of Tinadu; they are situated about 2½, 4, 5¾ and 8½ miles north-eastward, respectively, of Gafuri.

The islet of Warifuri stands near the southern extremity of Warra-Furra-Fhur, with the islet of Noradu lying between it and Dedu.

Eastern side.—From Kelai the barrier reef extends southward for about 9 miles to the eastern extremity of a detached, circular reef which encloses the island of Baura. The island of Fialdu lies between the above two islands with wide openings into the lagoon on either side.

Southward of Baura the barrier reef trends south-south-westward for about 20 miles to the island of Mavaidu. The islands and reefs, enclosing separate lagoons, of Hanimadu, Noliwang Faro, Nuriwari, Kuludu Faro and Komangdu, in that order from north to south, form the south-eastern side of the atoll, with wide openings into the lagoon

Charts 827, 748b.

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Chart 66a.

on either side of each of them; they are situated about 2¼, 7½, 11, 13¾ and 17 miles south-south-westward, respectively, of Baura.

Kuludu Faro.—In 1942 there was a very large village on Kuludu Faro fronted by a sandy beach and lagoon, which was enclosed on its western side by a coral reef. The boat channel was wider and deeper than is usual in the islands.

The islands of Nekurandu and Waikaradu, situated inside the lagoon at the southern end of the atoll, almost midway between Mavaidu and Muradu, were both inhabited in 1926.

Currents and tidal streams.—The currents in the northern part of the Maldive group set westward and north-westward from December to March inclusive; from May to October they set eastward and south-eastward, but are, at all season, subjects to a considerable degree of variability. April and November are months of transition.

At the northern end of the Maldive group the tidal streams, which attain a rate of about 1½ knots, are extremely irregular, and are at all times influenced by the prevailing winds and currents; thus, in the north-east monsoon the tidal stream during the ebb seems to run longer than it does in the opposite season. During strong westerly breezes the tidal stream during the flood sets eastward for the greater part of the day, but when the wind moderates the ebb takes its turn and sets westward in like manner, the water falling half a foot (0m1) lower than it ordinarily does at springs.

GALLANDU CHANNEL.—Tidal streams.—Gallandu channel, between the north-western end of Tiladummati atoll and the southern end of Ihavandiffulu atoll (*Lat. 7° 00′ N., Long. 72° 55′ E.*), about 2¾ miles northward, is very deep and free from dangers in the fairway. There are passages on either side leading into the lagoons, where anchorage can be obtained.

The tidal streams set in an east-north-easterly direction through Gallandu channel with the flood tide, and in a west-south-westerly direction during the ebb.

Chart 2068.

IHAVANDIFFULU ATOLL.—General remarks.—Ihavandiffulu atoll, the northernmost atoll of the Maldive group, is, for administrative purposes, included in Tiladummati atoll. There are about twenty-four islands in this atoll, the majority being of small size and the largest not more than 1½ miles in length; most of them lie on the circumference of the reef.

There are three islets in the central lagoon, which has general depths of from 20 to 30 fathoms (36m6 to 54m9) in the eastern half and from 10 to 20 fathoms (18m3 to 36m6) in the western half; there are, however, numerous shoal patches, particularly in the western half. These can easily be seen from the bridge or aloft, showing a distinct pale green colour in comparison with the dark shade of the deeper water, provided the sun is well up and not in a direct line with the shoal. In overcast weather the shoals are not so readily discerned.

Six of the islands are permanently inhabited and the total population, in 1934, was estimated to be rather more than 1,000.

Wood and water are obtainable, the latter of good quality but in small quantities only. Provisions are only available in limited quantities.

Charts 827, 1012, 748b.

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Chart 2068.

The principal industries are the cultivation of coconuts and fishing. Bonito is caught in large quantities; it is dried and sent to Male for export to Ceylon and India.

Communication with the other atolls is by sailing boat, but there is no regular service.

Western and northern sides.—Digufuri reef with an islet at its eastern end lies at the south-western corner of the atoll, bordering the northern limit of Gallandu channel.

A small sandbank, with palms on it, lies about 6½ cables east-north-eastward of the islet on Digufuri reef.

Ihavandu (*Lat. 6° 57′ N., Long. 72° 56′ E.*), an island situated close north-eastward of the western end of Digufuri reef, has a village near its centre which had, in 1934, a population of about 200. The landing place is on the southern side of the island.

Hauwandu, the southern extremity of which is situated about three-quarters of a mile westward of Ihavandu, was uninhabited in 1934, but, like the remainder of the islands and islets in this atoll, is used for the cultivation of coconuts.

Umbala, half a mile north-north-westward of Hauwandu, is the principal island of the atoll. There is a large village which, in 1934, had a population of about 500. A natural harbour, formed between the island and the seaward side of the reef, makes a good anchorage for the numerous fishing craft.

A chain of four islets, which were uninhabited in 1934, extends about 2¾ miles north-westward from Umbala. These islets are known, from south-east to north-west, respectively, as Hurafuri, Seybirfuri, Mafinur and Heronari. The central part of Mafinur, which lies about 1½ miles north-westward of Umbala, contains some traces of cultivation, but the remainder were, in 1934, thickly wooded.

Hatefuri, about 1¼ miles north-westward of Heronari, had, in 1934, a fishing village with about 100 inhabitants; on its north-eastern side a rough breakwater had been constructed to harbour fishing craft. The approach to this was, however, very shallow and hardly usable at low water.

The islet of Matari lies about three-quarters of a mile north-westward of Hatefuri. It was uninhabited in 1934, but was used as a cemetery and had a flagstaff and a small temple on it; elsewhere it was well wooded.

About 2½ miles northward of Matari is Kandufuri, an islet which was uninhabited in 1934, and densely wooded. For radar range *see* Appendix III on page 346.

Wagaru, a low well-wooded island, which was uninhabited in 1934, lies about 3¾ miles east-north-eastward of Kandufuri. It is surrounded by a reef, except for a short distance on its south-eastern side where there is a good landing place, though sometimes a moderate surf makes its use hazardous. For radar range *see* Appendix III on page 346.

Turakuna, the northernmost island of the atoll, is situated about one mile north-eastward of Wagaru. In 1934 there was a small village on its northern side. It is thickly wooded with scrub and coconut palms. A reef extends for some distance round the island and landing can only be effected on the southern side, where the reef is narrow and there are gaps between the coral heads. For radar range *see* Appendix III on page 346.

Charts 66a, 827, 1012, 748b.

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Chart 2068.

Eastern side.—Beacon.—The island of Uleguma (*Lat. 7° 05′ N., Long. 72° 56′ E.*), which lies about 1¼ miles south-eastward of Turakuna, is low-lying, level and thickly wooded. On the seaward side there is a narrow fringe of reef extending from the shore; a beacon is situated on the reef extending from the eastern side about 9 cables south-eastward of the northern extremity of the island. On the inner side the reef is some distance from the shore, and there are two openings in it through which fishing craft can enter the lagoon thus formed and reach the beach. In 1934 there was a village, with a population of about 150, in the centre of the island, surrounded by bread-fruit and coconut trees. For radar range *see* Appendix III on page 346.

Muladu, an island lying about 5 miles south-eastward of Uleguma, has a small village on its western side. It is surrounded by an almost unbroken reef, through which there is a boat passage, abreast the village, where there is good landing.

Between Uleguma and Muladu lie three small, thickly wooded and uninhabited islets known, from north-west to south-east, respectively, as Murdu, Beramundu and Gumati.

The islet of Gallandu lies about 3½ miles south-south-westward of Muladu and is uninhabited.

Openings.—Directions.—Approaching from northward the best entrances are North Rock passage between North rock and Wagaru, North Western entrance between Wagaru and Turakuna or Northern entrance between Turakuna and Uleguma (*Lat. 7° 05′ N., Long. 72° 56′ E.*) with depths of not less than 11 fathoms (20^{m}1). These passages should be effected midway between the islands; the edges of the reefs can easily be seen from aloft for some distance.

On the eastern side the best entrances are North Eastern entrance between Uleguma and Murdu, with a least depth of 19 fathoms (34^{m}7) midway between the two islands, or Eastern entrance between Muladu and Gallandu. In this latter opening, however, there are two shoal patches and the following directions were received in 1942:—A vessel using this entrance should bring the north-eastern side of Medufuri islet, near the centre of the lagoon, to bear 287° and keep it so, until the southern extremity of Muladu bears 070°, when the northern extremity of Hauwandu should be steered for, bearing 250°, and thence to the anchorage off Hauwandu (page 97).

On the western side there is only one opening, South Western entrance, immediately southward of Hauwandu, with depths of 13 to 14 fathoms (23^{m}8 to 35^{m}6) in mid-channel.

Dangers.—North rock, which lies about one mile westward of Wagaru, is a rocky patch with a least depth of 17 feet (5^{m}2) over it.

Ormonde rock, situated on a small shoal 2 miles south-westward of Uleguma, has a least depth of 15 feet (4^{m}6) over it.

Endeavour shoal, which lies about 3¼ miles south-south-westward of Uleguma, is a coral patch of considerable extent and has a least depth of 20 feet (6^{m}1) over it.

The three islands lying near the centre of the lagoon, already mentioned, are surrounded by rocky heads, foul ground and shoal water. They are known as Collingrufuri, Medufuri and Manafur, and lie about 3¾ miles south-south-westward, 3½ and 4½ miles southward, respectively, of Uleguma (*Lat. 7° 05′ N., Long. 72° 56′ E.*).

Two rocks, which dry 3 feet (0^{m}9) and one foot (0^{m}3), respectively,

Charts 66a, 827, 1012, 748b.

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Chart 2068.

are situated near the centre of a rocky shoal which lies close northward of the edge of the foul ground extending northward from Medufuri.

There are numerous dangers in addition to the above within the lagoon, particularly towards the north-western and south-western sides. Under suitable conditions they can easily be seen from aloft.

Anchorages.—The best anchorage is westward of Uleguma in 15 to 20 fathoms (27m4 and 36m6), sand and coral.

There is good anchorage eastward of the reef between Umbala and Hauwandu in 18 to 20 fathoms (32m9 to 36m6). This is probably the best anchorage during the south-west monsoon, but a heavy swell may possibly reach it through South Western entrance.

Good anchorage may be obtained, during the north-east monsoon, westward of Gumati and Muladu islands, in depths of from 25 to 30 fathoms (45m7 to 54m9).

There are also anchorages southward of Wagaru and Turakuna islands as indicated on the chart.

Currents and tidal streams.—At Ihavandiffulu atoll there appear to be no regular tidal streams. Current are only experienced occasionally and are probably influenced entirely by local weather conditions.

In December 1933 and January 1934 a set to the westward between Uleguma and Murdu, and to the north-westward between Uleguma and Wagaru, was sometimes observed, the maximum strength being about one knot. In the centre of the lagoon there was occasionally a slight set to the north-westward.

In the offing, during December and January, the current generally sets to the northward or westward, but it is irregular.

In December 1933, a 2-knot current, setting 360°, was experienced in a position 50 miles eastward of the atoll, but about a month later there was practically no current in this position.

Chart 827.

EIGHT DEGREE CHANNEL.—Currents.—Eight Degree channel, between Ihavandiffulu atoll and Minicoy island (*Lat. 8° 17′ N., Long. 73° 02′ E.*), about 70 miles northward, is free from dangers. It is recommended that vessels using this channel should keep nearer to Minicoy island than to the Maldives, as the current sets southward between the end of September and the close of the year, and there is the added advantage of sighting the light on Minicoy island.

The currents in this channel are much the same as at the northern end of the Maldives, but, in the north-east monsoon, they at times set in a north-westerly direction, and in a northerly direction when southerly winds occur, though, very rarely.

LACCADIVE ISLANDS.—Laccadive islands, meaning Laksha divi, the hundred thousand isles, consist of a group of coral atolls, lying about 200 miles from the Malabar coast (page 6), also a few detached reefs and banks.

Each of these islands is situated on an extensive coral shoal, with an area of 2 or 3 square miles; no parts of these formations are more than 10 or 15 feet (3m0 or 4m6) high. The outer edges are higher than the body of these shoals, and generaly enclose a regularly-formed lagoon in which it is calm, even in the worst weather. The receding

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Chart 827.

tide leaves the outer edge of the reef nearly dry, and the tide runs out of the lagoon through breaches in the edges, which are large enough to admit the light native craft into the natural harbour.

Owing to the great depths in their vicinity, sounding is of no assistance in approaching them, and great caution is therefore requisite in thick weather.

These islands and islets, being all low, with coconut trees only from 60 to 80 feet (18^{m}3 to 24^{m}4) high, are not discernible from any great distance, and should be avoided, but there are some safe and wide channels amongst them.

There is a Government dispensary on all the inhabited islands.

Under the surface of these islands lies a stratum of coral from 12 to 18 inches (0^{m}3 to 0^{m}45) deep; by breaking through this and removing the sand, fresh water may be obtained. This water rises and falls with the tide, and is reported to be wholesome but slightly brackish.

Produce.—There is little spontaneous vegetation in most of the islands, but the conditions are specially favourable to the growth of coconut palms, which is their staple product. There are, however, patches of tottam or garden land, on which ragi, millet, plantains and other vegetables are grown; limes and bread-fruit trees flourish, but no rice is produced. There are cattle, goats, fowls and cats on all the inhabited islands. There are few birds, but turtle and fish are plentiful.

SOUTHERN GROUP.—The southern group, which is known as Cannanore islands, consists of Mincoy island, Suheli Par (*Lat. 10° 04′ N., Long. 72° 16′ E.*), Kalpeni, Kavaratti, Pitti islet, Agatti and Androth. *Chart 827, with plan of Minicoy island.*

Minicoy island.—A small atoll, of which Minicoy island forms the south-eastern side, is situated about 70 miles northward of the northern extremity of Ihavandiffulu atoll. It is generally spoken of as one of the Laccadive group, though it is about 110 miles south-south-westward of Kalpeni island, the south-easternmost of the Laccadives proper. For radar ranges *see* Appendix III on page 346.

Western side of island.—Beacons.—Wiringili or Small Pox islet, which has some coconut trees on it, lies on the barrier reef about 5½ cables north-westward of Roebera point, which projects from the south-western extremity of Minicoy island.

Chart 827, plan of Minicoy island.

The western barrier reef dries in places and, about 1¼ miles northward of Wiringili islet, dries about 5 feet (1^{m}5).

Bojan Chor channel lies close northward of the two beacons on the barrier reef about half a mile northward of Wiringili islet.

Neru Magu channel, about 2 miles north-north-eastward of Wiringili, is a boat channel, with depths of from 2 to 3 feet (0^{m}6 to 0^{m}9), leading into the lagoon.

There is another smaller opening in the western barrier reef about three-quarters of a mile farther north-eastward.

From a position about 2 miles east-north-eastward of the smaller opening just described shoal water extends about 3 cables northward from the barrier reef.

At the north-eastern end of the atoll is the principal opening into the lagoon; this opening, which is called Tori Gandu channel, has depths

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Chart 827, plan of Minicoy island.

of from 6 to 12 feet (1m8 to 3m7) but is only available for small vessels with local knowledge.

Eastern side of island.—Beacon.—There are many coconut trees, from 80 to 100 feet (24m4 to 30m5) high, on the eastern side of Minicoy island (*Lat. 8° 17′ N., Long. 73° 03′ E.*).

On Kodi point, the north eastern extremity of Minicoy island, is a conspicuous palm; about one cable east-north-eastward of Kodi point, on the barrier reef, is a rock, 2 feet (0m6) high, and the barrier reef extends about one cable farther north-eastward.

The wreck of a large steamer was reported, in 1930, to lie about 3½ cables east-north-eastward of Kodi point; this wreck was reported by H.M.S. *Cornwall*, in 1933, to be very prominent, also that one funnel and two masts were still standing.

A 2-fathom (3m7) shoal lies about 3¾ cables north-eastward, and a 4-fathom (7m3) shoal about 4½ cables east-north-eastward, of Kodi point.

There is a small inlet on the east coast of Minicoy island, which is suitable for landing during the south-west monsoon.

Mou Rambu point lies about 2½ miles south-south-westward of Kodi point. Ko Vari bay is contained between Mou Rambu point and the reef-fringed, southern extremity of the island, known as Terveratio point.

Tunda point, near the extremity of which there are some trees, 50 feet (15m2) high, projects into the lagoon about 1½ miles west-north-westward of Terveratio point; its extremity lies about 3½ cables eastward of Wiringili island and about the same distance northward of Roebera point.

Light.—A light is exhibited at an elevation of 150 feet (45m7) from a white tower, 159 feet (48m5) in height, situated at the south-western end of Minicoy island, about 6 cables south-eastward of Tunda point. On certain bearings, and within distances of less than 6 miles, the top of this lighthouse is obscured by trees. *See* view [1].

A pier projects into the lagoon about 1½ cables northward of the lighthouse.

Caution.—Vessels have been wrecked on Minicoy island due to their apparently shaping course to pass a few miles northward of the light (in some cases after having sighted the light from the eastward), instead of passing southward, where the light is a useful guide.

In any case, the practice of passing a few miles northward, especially by night, is a dangerous one, because the island is over 4 miles long in a northerly and southerly direction, and the current sets in a southerly direction very strongly, at times.

Anchorages.—During the north-east monsoon vessels can obtain anchorage off the western side of the atoll, outside the barrier reef, with Minicoy island lighthouse (*Lat. 8° 16′ N., Long. 73° 01′ E.*) bearing 156°, distant 2½ miles, in depths of from 10 to 15 fathoms (18m3 to 27m4), sand and coral. The bottom rises steeply towards the reef, and slopes very steeply seaward.

In December 1881, H.M.S. *Ready* slipped off into deep water almost immediately after anchoring here in a depth of 15 fathoms (27m4); she then anchored in a depth of 10 fathoms (18m3), and the anchor held during the whole of her stay, a period of eight days; occasional squalls off the island were experienced during this period. When

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Chart 827, plan of Minicoy island.

swung towards the reef, with 40 fathoms of cable out, there was not less than a depth of 5 fathoms (9m1) under the stern.

In January 1938, no anchorage suitable for a vessel 300 feet (91m4) in length was found here; in the position described above, with the lighthouse bearing 156° distant 2½ miles, a depth of 120 fathoms (219m5), sand, was found; suitable depths were too close to the reef.

Vessels can obtain anchorage off the northern end of the atoll, westward of the north-eastern entrance to the lagoon.

During the south-west monsoon the only available anchorages are on the northern and eastern sides of the island. These anchorages are much more contracted than that on the western side of the atoll.

Vessels near the atoll should keep in blue water.

Directions for entering the lagoon.—Danger.—Anchorage.—Beacons.—Small vessels with local knowledge intending to enter the lagoon should proceed through the north-eastern opening; the channel is somewhat narrow, but the lighthouse, bearing 220°, leads through the fairway of the entrance, passing about 2 cables north-westward of the conspicuous tree on Kodi point.

A rock, with a depth of 3 feet (0m9) over it, about 6 cables south-south-westward of the north-eastern extremity of the north-western barrier reef, lies very close northward of the line of bearing given above; vessels should therefore mark this rock before entering unless possessing local knowledge, because the current here always sets on to Minicoy island.

After passing the rock described above a vessel should steer through a channel, about 3 cables from Minicoy island, in which there are depths of from 3 to 4 fathoms (5m5 to 7m3); this leads to an anchorage off the town, which is about 2¼ miles from the northern end of the island; care must be taken to avoid the shoals lying in this channel, the positions of which can best be seen on the plan.

The south-western part of the lagoon is mostly shallow.

Town.—Minicoy island (*Lat. 8° 17′ N., Long. 73° 03′ E.*) had, in 1951, a population of 3,447; the natives are darker and smaller than those inhabiting the other atolls of the Laccadives and Maldives, and are probably of Sinhalese origin. The language is Mahl, but many of the natives speak Hindustani.

Leprosy prevails, and there is a leper settlement about one mile northward of the town.

Storm warnings.—Storm warnings are received at Minicoy island but no signals are hoisted. *See* page 23.

Climatic table.—*See* page 44.

Chart 827.

Nine Degree channel.—Obstruction.—Discoloured water.—Nine Degree channel, between Minicoy island, southward, and Suheli Par, about 113 miles north-north-westward, and Kalpeni island, northward, is very deep and free from dangers, except for a submerged obstruction about 18 miles south-south-eastward of Kalpeni island, reported in 1942 by a vessel which struck it, and discoloured water and tide-rips reported in 1945, in a position about 20 miles south-south-westward of Kalpeni island.

Investigator bank, situated about 18 miles north-eastward of Minicoy island, has a depth of 119 fathoms fathoms (217m6); there are depths of from 500 to 600 fathoms (914m4 to 1,097m3) in the vicinity.

Charts 1012, 748b.

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Chart 827.

Suheli Par.—Anchorage.—Suheli Par, the south-westernmost atoll of the Laccadive group proper, consists of a barrier reef, which dries, enclosing a lagoon, in which lie North and South islets, both uninhabited; these islets were, in 1894, covered with scrub and palms and about 90 feet (27m4) high. For radar range *see* Appendix III on page 346.

There are two openings on the north-western side of the barrier reef available for small vessels with local knowledge and of a draught not exceeding 6 feet (1m8).

In January 1948, good anchorage was found in a depth of 6½ fathoms (11m9), sand, with the northern extremity North islet bearing 163° and the southern extremity of South islet 201°.

Chart 827, with plan of Kalpeni island.

Kalpeni.—Kalpeni, the south-easternmost atoll of the Laccadives situated about 77 miles eastward of Suheli Par, consists of two narrow low islands, standing on the eastern side of a reef, which encloses a lagoon.

In 1951, the population was 2,269.

Kalpeni island, the southern and larger island, is well planted with coconut trees; a steep-to bank, with depths of from 4 to 9 fathoms (7m3 to 16m5), extends about 4½ cables southward from the southern end of Kalpeni island (*Lat. 10° 04′ N., Long. 73° 38′ E.*). For radar range *see* Appendix III on page 346.

Coconuts and coir rope, made from their fibre, are exported, the trade being maintained by a sailing vessel from Calicut or Mangolore which visits the island periodically.

Cheriyam, the northern island, is wooded, the trees being, in 1909, 62 feet (18m9) high.

The barrier reef is steep-to, and the sea breaks heavily on it; through one part of the reef there is a narrow boat channel leading into the lagoon. Landing is sometimes possible on the eastern side of the island.

Anchorage.—In March 1950, I.N.S. *Sutlej* anchored off the southern side of the island, about 3½ cables offshore, in a depth of 7 fathoms (12m8), coral, sand and rock.

Chart 827.

Kavaratti.—Anchorage.—Kavaratti, situated about 28 miles north-eastward of Suheli Par, is a low-lying island; there were, in 1909, a few palms and a growth of shrub on its southern part, but its northern part was thickly planted with coconut palms, which were about 90 feet (27m4) high. In 1951, the population was 2,250.

A village is situated on the north-western side of the island, where a considerable trade is carried on with Calicut and Mangalore, the exports being mats and coir rope.

On the north-western side of the island there is a coral reef enclosing a shallow lagoon; this reef lies nearly parallel to the beach, and extends to a distance of 6 cables offshore. The reef is steep-to, except at its southern end; there are depths of 100 fathoms (182m9) at a distance of from 2 to 3 cables from the reef.

In the boat entrance at the northern end of the lagoon there is a depth of 3 feet (0m9).

Vessels can obtain anchorage during the north-east monsoon in depths of from 4 to 7 fathoms (7m3 to 12m8), sand and coral, on a

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Chart 827.

shoal, which extends about 7 cables southward from Kavaratti (*Lat. 10° 33′ N., Long. 72° 36′ E.*), and is 7 cables wide.

The channel between Suheli Par and Kavaratti is very deep and free from dangers.

Tidal streams.—In October, the tidal streams in the vicinity of Kavaratti were observed to set in a south-easterly direction with the flood tide, and in a north-westerly direction with the ebb, and to have a rate of from half a knot to one knot.

Pitti.—Pitti, an islet with an area of about 2 acres, situated about 12 miles north-north-westward of Kavaratti, is low-lying, and, in 1909, there were no shrubs or verdure on it; there is a black rock on its eastern side.

The north-eastern and northern sides of Pitti are sandy, and the remainder rocky; there were, in 1909, several stone cairns, about 20 feet (6^{m}1) high, on the islet.

The only landing place is on the northern side of the islet, and then only during good weather.

A bank of sand and coral, with a breadth of 10 miles at its widest part, extends about 3 miles southward and about 21 miles north-north-eastward from Pitti; the charted depths on this bank are from 6 to 20 fathoms (11^{m}0 to 36^{m}6), but they may be less, as it has not been thoroughly examined.

Kalputhi and Agatti.—Kalputhi, about 22 miles westward of Pitti, is an uninhabited islet, situated at the southern end of an unnamed atoll.

Agatti, a narrow island close north-north-eastward of Kalputhi, and on the same atoll, has a clump of coconut palms which makes a good landmark, about one mile from its southern end; the northern part of this island, for a distance of about 2½ miles from its northern end, is thickly planted with coconut palms, which are about 80 feet (24^{m}4) high, but the remainder of the island is covered with scrub.

In 1951, Agatti had a population of 2,038. There are poultry and a few sheep and goats; the main produce is coconuts. Abundant supplies of water can be obtained from wells.

There is communcation with Calicut and Mangalore, except for about four months during the south-west monsoon.

The landing is on the north-western side of Agatti, about one mile from its northern end. The beach, which shelves rapidly, is steep-to.

Both Kalputhi (*Lat. 10° 48′ N., Long. 72° 09′ E.*) and Agatti are surrounded by a coral reef, which on the western side extends to a distance of about 2 miles offshore, and encloses a shallow lagoon; the entrance to this lagoon bears 322° from the clump of coconut palms on Agatti, and is always available for boats.

Bingaram, an islet on the south-eastern side of the atoll, about 5½ miles east-north-eastward of the northern end of Agatti, is about three-quarters of a mile long in a northerly and southerly direction, and about half a mile wide at its widest part. The encircling reef extends about one mile south-westward, and about 3 miles north-westward and north-eastward from the islet; this reef is steep-to on its northern and eastern sides.

Tinnakara, an islet, lies about one mile within the north-eastern point of the atoll, with which it is connected by a chain of low islets and sand cays.

Charts 1012, 748b.

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Chart 827.

Both the above islets were, in 1894, covered with trees about 80 feet (24m4) high; they were then uninhabited; no good water can be obtained. There are good landings.

Anchorages.—Anchorage can be obtained off the entrance to the lagoon, enclosed by the reef surrounding Kalputhi and Agatti, in depths of from 10 to 12 fathoms (18m3 to 21m9), coral, but it is not recommended.

Between Agatti and Bingaram there are depths of from 5 to 9 fathoms (9m1 to 16m5), and this area is apparently free from dangers; good anchorage can be obtained in any part of this area, but vessels should proceed with caution.

In 1948, H.M.I.S. *Sutlej*, drawing 11½ feet (3m5), anchored in a depth of 6½ fathoms (11m9), with Bingaram bearing 056° and Kalputhi 173°.

On the western side of the atoll, near its northern end, there is an entrance to the lagoon about three-quarters of a mile wide, westward of which good anchorage may be obtained with the northern point of Bingaram islet bearing 078° in a depth of 5½ fathoms (10m1), coral.

Chart 827, with plan of Andrōth island.

Andrōth.—Andrōth (*Lat. 10° 50′ N., Long. 73° 40′ E.*), an island situated about 42 miles northward of Cheriyam, is the nearest of the Laccadives to the Malabar coast; this low-lying island is the most fertile of the group, and is well planted with coconut trees.

The village, which is situated about one mile from the western end of the island, had a population, in 1951, of 3,659. The water is brackish with a high lime content. There is a leper colony on the island.

Andrōth is surrounded by a coral reef, through which there is only one small channel for boats; the southern side of this reef is steep-to, but from the northern side a coral bank extends for about 5 miles in a northerly direction, and has a greatest width of about 11 miles, with depths of from 7 to 20 fathoms (12m8 to 36m6) over it. A 6-fathom (11m0) patch lies about 1½ miles north-eastward of the red roofed mosque in the middle of the village.

Anchorages.—Vessels with local knowledge can obtain anchorage anywhere off the northern side of Andrōth, about half a mile offshore, in depths of from 5 to 6 fathoms (9m1 to 11m0), sand and coral.

In January 1948, H.M.I.S. *Sutlej* found good anchorage, in a depth of 5½ fathoms (10m1), sand and rock, with a red-roofed mosque standing amongst the trees on the western side of the village bearing 167°, distant about 5 cables.

Vessels with local knowledge can also obtain anchorage off the eastern end of the island, where the bottom appears to be smoother, in depths of from 9 to 10 fathoms (16m5 to 18m3), sand and rock.

During the north-east monsoon vessels can anchor off the south-western side of the island, about a quarter of a mile offshore, with its north-western extremity bearing about 022°, and its south-western extremity bearing about 101°, in depths of from 10 to 12 fathoms (18m3 to 21m9), but there is little shelter here.

There are two or three landing places on the northern side of Andrōth the best being abreast the village.

Chart 827.

NORTHERN GROUP.—The northern group is known as Amindivi

Charts 1012, 748b.

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Chart 827.

islands. It consists of Amini (*Lat. 11° 07′ N., Long. 72° 44′ E.*), Kadmat, Kiltān, Chetlat and Bitrā.

Chart 827, with plan of Amini island.

Amini and Kadmat.—Beacons.—Amini, an island situated about 22 miles north-north-eastward of Pitti, is the most important of Amindivi islands, and had a population, in 1951, of 3,159. It is fringed by a reef from about 2 to 4 cables wide; the trees on this island were, in 1909, 101 feet (30^{m}8) high.

There was, in 1948, a raised stone platform, with steps leading down to the beach, in front of the village in the middle of the western side of the island. Behind the stone platform there is a stone pillar which is conspicuous from north-westward; in front of the platform a passage across the reef is marked by beacons in the form of rock pillars.

Chart 827.

Kadmat, an island, the southern end of which is situated about 4 miles north-north-eastward of Amini, forms the eastern side of a cotal atoll; the centre of the island was, in 1909, thickly planted with coconut palms, which were 85 feet (25^{m}9) high; the extremities of the island are covered with a low growth of scrub. In 1951, it had a population of 1,642.

The coral reef, which dries and encloses a shallow lagoon, extends nearly parallel with the island at a distance of about three-quarters of a mile from its western side, and embraces both the southern and northern ends of the island; it extends about 1¼ miles southward of the southern end, and about a quarter of a mile northward of the northern end of Kadmat (*Lat. 11° 13′ N., Long. 72° 46′ E.*).

The only opening in this reef is a narrow boat channel near the northern end of the island, but native boats pass over the reef in some parts at high water.

There is a village in the centre of the island.

There is a comparatively narrow but a safe and deep channel between Amini and Kadmat.

Chart 827, with plan of Amini island.

Anchorages.—During the north-east monsoon a vessel with local knowledge can anchor close off the reef on the south-western side of Amini, in depths of from 8 to 10 fathoms (14^{m}6 to 18^{m}3).

H.M.I.S. *Sutlej*, which visited Amini in 1948, approached her anchorage with the above-mentioned steps bearing 107°, and anchored on that bearing about 4¾ cables from the beach, in a depth of 5 fathoms (9^{m}1); boats approach the steps by a channel marked by pillars formed of rock.

Chart 827.

Depths of less than 20 fathoms (36^{m}6) extend about 4 cables southward from the reef southward of Kadmat, and in fine weather vessels with local knowledge can obtain anchorage here in depths of from 15 to 20 fathoms (27^{m}4 to 36^{m}6).

Small vessels with local knowledge can anchor near the boat passage near the northern end of Kadmat, about 2 cables from the reef, in a depth of 17 fathoms (31^{m}1).

Elikalpeni bank.—Elikalpeni bank, lying about 32 miles north-eastward of Androth (*Lat. 10° 50′ N., Long. 73° 40′ E.*), is composed of sharp coral rocks. The bank, which was examined by I.N.S. *Investigator* in 1953, is about 4 miles in extent with general depths of

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Chart 827.

7 to 9 fathoms (12m8 to 16m5) and a least depth of 34 feet (10m4) near the south-eastern edge. The bank is steep-to, falling rapidly to depths of about 1,000 fathoms (1,828m8).

Depths of from 9¾ to 17 fathoms (17m9 to 31m1) have been reported between 20 and 22 miles eastward of Elikalpeni bank, and others of from 12 to 16 fathoms (21m9 to 29m3) have been reported between 16 and 22 miles east-north-eastward of the bank. In view of these reports, it is recommended that theses areas should be avoided, particularly when the south-west monsoon is strong enough to raise a considerable sea.

The channel between Elikalpeni bank and the coral bank northward of Andrōth is very deep and free from dangers.

Peremul Par.—Peremul Par, which is situated about 17 miles north-north-westward of Agatti, is a reef enclosing a lagoon; this reef, which is very narrow, dries, but at high water, with a smooth sea, the edge is difficult to distinguish, as in many parts it does not break. Near the north-eastern end of Peremul Par there was, in 1894, a sand cay, 4 feet (1m2) high.

Within the reef and extending towards the centre for about three-quarters of a mile, round its south-western and northern sides, there is a flat with depths of less than 6 feet (1m8); the remainder of the lagoon is encumbered with coral reefs, which dry; the depths between are from one to 6 fathoms (1m8 to 11m0).

There are several good boat entrances on the eastern, and two on the western, sides of Peremul Par.

Anchorages.—During northerly winds anchorage can be obtained by vessels with local knowledge on the south-western side of Peremul Par, abreast the boat entrances, at a distance of 3 cables offshore, in a depth of 10 fathoms (18m3).

There is anchorage for vessels with local knowledge off the north-eastern side of the reef, with the sand cay bearing 213°, distant 4½ cables, in depths of from 10 to 12 fathoms (18m3 to 21m9).

Chart 827, with plan of Kiltān island.

Kiltān.—Kiltān (*Lat. 11° 29′ N., Long. 73° 00′ E.*), an island situated about 19 miles north-eastward of Kadmat, is well covered with trees. It had a population, in 1951, of 1,252.

Water can be obtained from wells, but is brackish with an excessive lime content.

Kiltān is steep-to on its eastern side, but is fringed by a reef on its western and southern sides; this reef extends about 3½ cables from its western side, and one cable southward from its southern end; shoal water extends about a quarter of a mile southward and 1½ cables westward from the reef.

Light.—A light is exhibited, at an elevation of 45 feet (13m7), from a wooden trestle tower, 40 feet (12m2) in height, situated about 1½ cables south-eastward of the north-western extremity of the island.

Anchorages.—The best anchorage off Kiltān is with the north-western point of that island bearing 124°, distant about half a mile, in depths of from 7 to 8 fathoms (12m8 to 14m6); vessels should anchor a little closer inshore during southerly winds. This position is near the boat passage through the fringing reef, which leads to the landing place. About 6 cables southward of this passage there is another gap in the reef, in which it is smoother, at times, than in the northern opening.

Charts 1012, 748b.

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Chart 827, with plan of Kiltān island.

Anchorage can also be obtained off the southern end of this island, about 3½ cables offshore, in depths of from 5 to 6 fathoms (9m1 to 11m0), when swell conditions permit.

Chart 827.

Discoloured water.—Two patches of discoloured water of a light greenish-brown colour, were reported, about 4½ cables apart, in 1919, about 45 miles north-north-eastward of Kiltān.

Chart 827, with plan of Chetlat island.

Chetlat.—Chetlat (*Lat. 11° 41′ N., Long. 72° 41′ E.*), an island situated about 21 miles west-north-westward of Kiltān, is wooded. In 1917 the inhabitants were mainly fishermen.

The population in 1951 was 994.

The staple product of the island is coconuts. Coir is made, and limestone and coral exported to India.

Water can be obtained from wells, but is brackish with an excessive lime content.

A coral reef stretches round the southern and western sides of Chetlat, extending to a distance of about 5 cables from its western side; shoal water extends about 3½ cables south-south-westward from the southern end of the island, about 3½ cables westward from the coral reef, and about 5½ cables west-north-westward and 1½ cables northward from the northern end of the island.

Anchorages.—Vessels can obtain anchorage in fine weather on the shoal areas extending south-south-westward from the southern end, and northward from the northern end, of Chetlat.

The best anchorage during the north-east monsoon is off the southern end of this island, about 3½ cables offshore, with the south-western extremity of the barrier reef bearing about 338°, and the south-western and south-eastern points of Chetlat bearing 011° and 045°, respectively, in depths of from 6 to 10 fathoms (11m0 to 18m3).

In January 1948, H.M.I.S. *Sutlej* found the best anchorage to be slightly westward of that recommended above, in a depth of 6½ fathoms (11m9) with the south-western and south-eastern points of the island bearing 013° and 043°, respectively; the anchorage was uncomfortable as she lay across her cable on both flood and ebb streams. The south-western extremity of the barrier reef was no longer a good mark.

It is advisable to employ a native boat when landing on Chetlat; the best landing place is on the southern side of the island, near its south-eastern point, where there is a depth of 7 feet (2m1) at high water and 4 feet (1m2) at low water.

Chart 827.

Bitrā.—Bitrā (*Lat. 11° 33′ N., Long. 72° 09′ E.*), an atoll, the southern extremity of which is situated about 17 miles north-north-eastward of Peremul Par (page 107), encloses a lagoon; the barrier reef, which dries from one to 3 feet (0m3 to 0m9), narrows on the western and northern sides of the atoll, but increases in width on its eastern and southern sides. Turtle may be found on this atoll. In 1951, the population was 76.

Tree islet, situated at the northern extremity of the atoll, is about half a mile in length in a north-westerly and south-easterly direction, and about one cable in width; the centre was, in 1894, covered with coconut palms, about 55 feet (16m8) high.

Two sandy cays, above water, were, in 1894, situated on the eastern

Charts 1012, 748b.

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Chart 827.

part of the reef, southward of Tree islet; between these cays the sand dries in patches.

Close southward of Tree islet there is an opening in the reef half a mile wide, with depths of 9 feet (2m7), where boats can enter the lagoon.

The depth within the lagoon is from 3 to 4 fathoms (5m5 to 7m3); there are, however, many coral reefs, awash or drying, in the interior, especially towards the southern end.

Anchorage can be obtained abreast the opening southward of Tree islet, with the north-eastern extremity of that islet bearing 335°, distant about 6 cables, in a depth of 10½ fathoms (19m2).

Caution.—In January 1948, H.M.I.S. *Sutlej* reported that the anchorage described above was unsafe for a vessel 300 feet (91m4) in length as there is insufficient swinging room; she found no safe anchorage in the vicinity.

Tidal streams.—The tidal streams at spring tides set strongly in and out of the lagoon, and care is therefore necessary on this account when making the anchorage.

Byramgore reef.—Byramgore or Chereapani reef, the south-eastern end of which is situated about 24 miles north-westward of Tree islet, is sunken, except for the south-eastern point of the reef, which dries.

There are shoal depths on all sides of this reef, but the shoal area on the northern side is about 2 miles broad, with depths of from 4 to 8 fathoms (7m3 to 14m6), and is indicated by overfalls; this latter area may, however, have less depths, and it should be avoided, for it is encumbered with coral rocks, which can be plainly seen from a vessel passing over them; the coral rocks forming the reef are discernible at low water.

The channel between Bitrā (*Lat. 11° 33′ N., Long. 72° 09′ E.*) and Byramgore reef is very deep and free from dangers.

Cherbaniani reef.—Cherbaniani or Beleapani reef is the northernmost dangerous reef of the Laccadives. It is situated north-north-eastward from Byramgore reef, and separated from it by a very deep channel, about 17 miles wide and free from dangers. At the southern end of the reef there was, in 1894, a sand cay, and there were then an islet and some sandbanks on its eastern and northern sides, but the greater part of the barrier reef is only visible towards low water; there are apparently some boat passages leading into the lagoon.

The north-western, northern and eastern sides of this reef are steep-to, but from its southern and western sides a bank extends to a distance of about one mile, on which vessels can anchor during the north-east monsoon in depths of from 9 to 10 fathoms (16m5 to 18m3).

Current and tidal streams.—In the vicinity of Byramgore and Cherbaniani reefs the current frequently sets 12 or 15 miles during the night in uncertain directions, especially in the unsettled weather at the change of the monsoons; the direction is usually between south-east and south-west during the months of March and September. The direction is usually north-westerly in November to January.

The tidal streams in the vicinity of these reefs set in a north-easterly direction with the flood tide, and in a south-westerly direction with the ebb. The latter stream is the stronger and runs for from 8 to 10 hours at springs during the north-east monsoon, when the drain of current

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Chart 827.

runs with it; at that season the flood stream is scarcely perceptible, although the regular rise of tide is visible on the reefs.

Banks at northern end of the Laccadive group.—Bassas de Pedro, the southern end of which is situated about 49 miles northward of Chetlat, is a large steep-to bank with depths of from 18 to 40 fathoms (32^{m}9 to 73^{m}2), sand, shells and decayed coral; the water on the bank is not discoloured.

Depths of 13 and 19 fathoms (23^{m}8 and 34^{m}7) were reported, in 1946, to lie about 17 miles northward and 27¾ miles north-north-westward, respectively, of the southern extremity of this bank; the former depths also lies close to the eastern edge of the bank.

A depth of 19 fathoms (34^{m}7) was reported in 1952, to lie about 14 miles north-north-westward of the southern extremity of this bank.

Sesostris bank, about 10 miles westward of the centre of Bassas de Pedro, has depths of from 11 to 42 fathoms (20^{m}1 to 76^{m}8); it is steep-to.

Cora Divh (*Lat. 13° 40′ N., Long. 72° 10′ E.*), about 14 miles west-north-westward of the northern end of Bassas de Pedro, has depths of from 15 to 30 fathoms (27^{m}4 to 54^{m}9), sand, decayed coral and broken shells.

Charts 1012, 748b.

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CHAPTER III

COLOMBO TO CAPE COMORIN, INCLUDING THE GULF OF MANNAR

Chart 828.

GULF OF MANNAR.—The southern boundary of the Gulf of Mannar, about 202 miles in extent, is contained between Point de Galle, the south-western point of Ceylon, and Cape Comorin, the southernmost extremity of India. Its northern limit is a chain of islets and rocks, known as Adam's Bridge, extending from the western extremity of Mannar island (*Lat. 9° 04′ N., Long. 79° 47′ E.*) to Pamban island, about 16 miles west-north-westward.

A narrow tongue of land, named Thonithorai, projects eastward from the Indian coast to within about one mile of the western extremity of Pamban island. These two points are joined by a rocky barrier through which there is a partly artificial, navigable channel for small vessels, known as Pamban pass. *See* page 128.

Eastern side of gulf.—Aspect.—The west coast of Ceylon is low near the coast, and almost entirely planted with coconut trees. The foothills of the mountain district abreast Colombo begin about 20 miles inland. Adam's peak (page 3), the highest land visible from the offing, is an excellent mark during the north-east monsoon, but is seldom seen during the remainder of the year.

Hiniduma Kanda (Haycock), about 44 miles south-eastward of Colombo, is 2,160 feet (658^{m}4) high, and appears from all bearings as a large round-topped mountain; it is conspicuous and only occasionally obscured by mist.

Depths offshore.—There are depths of 100 fathoms (182^{m}9), about 12 miles westward of Colombo, with depths of less than 30 fathoms (54^{m}9) immediately eastward of them; this steep edge forms a valuable guide when making the land in thick weather or at night. The coastal bank is fairly level, and off Colombo, there are depths of 10 fathoms (18^{m}3) to within between one and 3½ miles of the shore.

For details of the coast and harbours southward of Colombo, *see* Bay of Bengal Pilot.

Climate and weather.—*See* page 29.

COLOMBO AND APPROACHES.—Aspect.—Lights.—In the vicinity of Colombo the land is low and will therefore not be seen from any great distance, but in exceptionally clear weather, Adam's peak and the other mountains of Ceylon may be visible from a great distance. *Charts 914, 3686.*

On closing the land, the buildings in that part of the town lying at the southern end of the harbour and known as The Fort, will first be seen at a distance of about 12 miles. There are several prominent high buildings in The Fort, including the Grand Oriental hotel surmounted

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Charts 914, 3686.

by three small round turrets, the clock tower and the National Mutual offices with its twin towers. On the western side is the black and white tower of Colombo lighthouse. For radar ranges *see* Appendix III on page 346.

On a nearer approach the following landmarks may be identified:—St. James church with twin towers and St. Lucia's cathedral with a dome, both situated near the northern end of the town about 1½ miles north-eastward of Colombo lighthouse; All Saints church with a tall spire, situated about one mile eastward of the lighthouse; the new town hall with a white dome, about 1¼ miles south-eastward of the lighthouse; and Galle Face hotel, a large red building on the coast about 9 cables south-south-eastward of the lighthouse. About 5½ miles southward of this hotel is Mount Lavina hotel, 96 feet (29m3) high and painted white, and about three-quarters of a mile north-eastward of the latter is a conspicuous banyan tree.

Colombo light is exhibited, at an elevation of 85 feet (25m9), from a circular stone tower, painted in black and white chequers, 49 feet (14m9) in height, situated on the seaward side of The Fort.

A *red* obstruction light is exhibited, at an elevation of 305 feet (93m0), from each of two steel framework radio masts, 270 feet (82m3) in height, situated about 2½ miles east-south-eastward of Colombo lighthouse.

Current.—Off Colombo the current is variable and its rate is seldom more than half a knot, though in the vicinity of shoal water it usually sets northward at a rate of 1½ knots during the north-east monsoon.

Dangers in approaches.—Buoyage.—Galua rock, also known as Drunken Sailor rock, is a shoal with two rocky heads; the western, situated about 4½ cables west-south-westward of Colombo lighthouse (*Lat. 6° 56′ N., Long. 79° 50′ E.*) and about 4 cables offshore, has a least depth of 4 feet (1m2) over it; the eastern head has a least depth of 10 feet (3m0). The sea breaks over these heads during the south-west monsoon. A red conical buoy is moored 2½ cables westward of the western head.

Pala gala, also known as Tartar rock, is a pinnacle rock with a depth of 19 feet (5m8) over it, lying about 5 cables north-westward of Colombo lighthouse and about 4 cables offshore; it is steep-to, and never breaks; it is marked on its western side by a red conical buoy, surmounted by a cone.

Kelani gala, a narrow bank, with a least depth of 9 fathoms (16m5), lies with its southern end about 1¾ miles west-north-westward of Colombo lighthouse.

Ona gala is a narrow ridge of dark sand and rock, the southern end of which lies about 3½ miles northward of Colombo lighthouse. The least depth over the ridge is 3½ fathoms (6m4) over a head named Galwala near its northern end. There are several other heads with depths of less than 5 fathoms (9m1) over them, having depths of from 6 to 7 fathoms (11m0 to 12m8) between.

Ona Gala can light-buoy, painted red and exhibiting a *white flashing* light *every five seconds*, is moored about 2¾ cables south-westward of the southern end of Ona gala.

Chart 3686.

Directions.—When making Colombo from westward it is better to

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Chart 3686.

be southward than northward of the port as there are no conspicuous objects northward, while southward there is Mount Lavinia hotel.

Approaching from westward, vessels should steer to make Colombo lighthouse bearing about 090° until the position is ascertained when a course clear of danger may be shaped for the harbour. Coming from northward or southward, vessels should keep outside the 20-fathom (36m6) line until the lighthouse bears 090°, and then proceed as above.

Port limits.—The limits of the Port of Colombo are bounded as follows:—On the south, by a line drawn due west for a distance of 3 miles from a position on the beach about one mile south-south-eastward of Colombo lighthouse (*Lat. 6° 56′ N., Long. 79° 50′ E.*); on the north, by a line of the same length drawn in a 263° direction from a position on the beach about 1½ miles north-north-eastward of Mutwal point, situated about 2 miles north-north-eastward of Colombo lighthouse; on the west, by a line joining the western ends of the northern and southern limits; and on the east, by the shore between the northern and southern limits.

Chart 914.

Breakwaters.—Lights.—Signal station.—The harbour is artificially formed by three breakwaters which enclose an area between the northern side of The Fort, and Mutwal point. The southern end of the harbour is connected with Colombo lake by a canal with locks which has a depth of 7½ feet (2m3). The canal is being dredged to a depth of 10 feet (3m0).

South West breakwater, built of concrete blocks, extends about 8½ cables northward from a position about 4 cables north-north-eastward of Colombo lighthouse.

About 2½ cables southward of the outer end of South West breakwater, an arm extends about one cable north-north-eastward and terminates in the pilot station; a spur projects a short distance south-south-eastward from the head of the arm and forms a landing jetty.

The port signal station is situated at the pilot station. Day watch only is kept at the signal station but day and night watch is maintained at the pilot station.

A light is exhibited, at an elevation of 56 feet (17m1), from a concrete tower, 61 feet (18m6) in height, situated on the head of South West breakwater.

A light is exhibited, at an elevation of 32 feet (9m8), from an iron column on the head of the pilot station landing jetty.

A light is exhibited, at an elevation of 50 feet (15m2), from a position about a quarter of a cable north-north-westward of the head of the pilot station landing jetty.

Island breakwater, also built of concrete blocks, extends about 4½ cables north-eastward from a position about 1¼ cables east-south-eastward of the head of South West breakwater.

Lights are exhibited, at an elevation of 42 feet (12m8), from two stone-coloured cylindrical towers, 40 and 37 feet (12m2 and 11m3), respectively, in height, situated one on the southern, and one on the northern, end of Island breakwater.

North East breakwater extends about 2 cables westward from Mutwal point.

A light is exhibited, at an elevation of 44 feet (13m4), from a concrete

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Chart 914.

tower, 33 feet (10m1) in height, situated on the northern corner of the outer end of North East breakwater.

Outer roadstead.—Anchorage.—Ballast, ashes or other refuse must not be thrown overboard in depths of less than 12 fathoms (21m9).

Vessels awaiting berths, or in quarantine, or not wishing to enter harbour for any other reason, should anchor about 1½ miles north-north-west of the northern entrance to the harbour, in an area the centre of which is in lat. 6° 59′ N., long. 79° 50·5′ E. (approx.). Vessels are requested not to anchor within one mile of the harbour entrances.

Pilots.—The pilot station (*Lat. 6° 57′ N., Long. 79° 51′ E.*) is situated on the spur of South West breakwater. Pilots are available throughout the 24 hours; the port is open day and night.

Pilotage is compulsory for all merchant vessels excepting such as are exempted by authority of the Master Attendant.

A vessel intending to enter the harbour should make one of the signals prescribed by the International Code and indicate her name and draught as soon as she arrives within visual signalling distance of the port.

To facilitate embarkation of the pilot, a vessel should, unless previously intercepted by the pilot launch, pick him up about one mile north-north-westward of South West Breakwater lighthouse, as indicated on chart 3686, approaching the position, when possible, on a south-easterly course.

A motor launch, exhibiting the customary signals, will board vessels in this position.

Until boarded by a pilot, no vessel should approach the port within this position, unless requested to do so.

The following provisions should be made to assist the pilot boarding:—

A pilot ladder should be shipped on the lee side. A boat rope is not required.

Two manropes of at least 3-inch rope, with the lower ends free, to be hung from the vessel's rail.

By night, a bright light to be shown midway between rail and water to indicate the position of the ladder and the manropes.

In vessels of high freeboard fitted with gangway doors, the lee gangway door to be opened and the ladder and manropes hung from there.

At night the intentions of the pilot will be signalled. *See* page 117.

In the event of the weather conditions being such as to preclude the vessel being boarded by a pilot outside the harbour, she may, at the discretion of the Master Attendant, be given the option of proceeding into harbour and picking up the pilot inside, the vessel being instructed by signal whether to run in or stand off.

Option to enter is not given at night under normal circumstances.

Vessels waiting to enter should remain under way as convenient, well clear of both entrances.

A vessel intending to leave harbour should make one of the signals for a pilot (*see* page 117) half an hour before she is ready to sail.

In normal circumstances the pilot will leave an outgoing vessels as she passes the pilot station.

If at any time assistance is required from the Master Attendant's department the signal should be made for a pilot. *See* page 117.

Charts 3686, 3700, 68b, 813, 828, 2898, 70, 748b.

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Chart 914.

Entrances.—Depths.—The western entrance (*Lat. 6° 57′ N., Long. 79° 51′ E.*) between South West and Island breakwaters, is about 1¼ cables wide and carries a least depth of 38 feet (11m6). It is available for vessels of 34 feet (10m4) draught. There is a disturbed swell across this entrance during the south-west monsoon.

The northern entrance between Island and North East breakwater, is just over one cable wide and carries a least depth of 32 feet (9m8). It is available for vessels of 29 feet (8m8) draught.

Vessels may enter and leave the harbour by whichever entrance is the more convenient, subject to the northern entrance being restricted to vessels of 29 feet (8m8) draught and under. At night, vessels pass midway between the *red* and *green* lights on the breakwater heads.

The central portion of the harbour has depths of from 32 to 42 feet (9m8 to 12m8) and the greater part of the remainder has depths of over 30 feet (9m1), as shown on the chart. Vessels are not permitted to navigate the harbour or to lie at moorings with a depth of less than 2 feet (0m6) under their bottoms, excepting by special sanction of the Master Attendant.

Piers and jetties.—Lights.—Prince Vijaya quay, a jetty capable of accommodating two large cargo vessels in a depth of 32 feet (9m8), is situated on the southern side of North East breakwater.

North and South piers extend westward from the eastern side of the harbour about 1½ and 2 cables, respectively, southward of Prince Vijaya quay. Only the southern side of North pier is quayed.

The area between North and South piers is known as the Oil dock and can be closed by a boom; it can accommodate four large tankers, berthed alongside the southern side of North pier and the northern side of South pier; both piers, which have depths of 35 feet (10m7) alongside, are equipped with oil pipe-lines.

The tall red-brick chimney of the dry dock pumping station (*Lat. 6° 57′ N., Long. 79° 51′ E.*), situated near the root of South pier, is conspicuous.

Guide pier, on the southern side of South pier, can accommodate two vessels with draughts up to 30 feet (9m1) in the outer berth and 28 feet (8m5) in the inner berth. The entrance to the two dry docks is situated at the eastern end of this pier, and vessels berthed at it have to be moved clear when other vessels are entering or leaving the dry docks.

Coconut oil can be loaded at Guide pier by pipeline from storage tanks ashore at a rate of 180-300 tons an hour.

Two lights, disposed vertically, are occasionally exhibited, at elevations of 25 and 19 feet (7m6 and 5m8), respectively, from an iron column on the head of Guide pier.

Southward of the entrance to the dry docks there is a range of 18 wooden coaling jetties for lighters, with depths of about 15 feet (4m6) alongside them. Farther southward are several other jetties including Block jetty, on which is a flagstaff, and Patent Slip jetty, for the patent slip.

A light is exhibited, at an elevation of 17 feet (5m2), from the head of Patent Slip jetty.

Delft pier, about three-quarters of a cable in width, extends northward for 2¼ cables from the southern side of the harbour; there are berths for deep-draught vessels on each side of this pier and across

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Chart 914.

the head. In 1958 it had depths of 30 feet (9m1) alongside its head, from 30 to 32 feet (9m1 to 9m8) alongside its eastern side and from 33 to 36 feet (10m1 to 11m0) alongside its western side. The maximum permitted draught for vessels using Delft pier is 2 feet (0m6) less than the depth alongside.

A light is exhibited, at an elevation of 50 feet (15m2), from a white mast situated about 1½ cables southward of the root of Delft pier.

Queen Elizabeth quay, about half a mile in length, is situated westward of Delft pier and forms the eastern side of the southern part of South West breakwater; there are berths for four large vessels alongside the northern part of this quay in depths of 36 feet (11m0), and for smaller vessels further southward.

Mooring berths.—Leading lights.—There are numerous mooring berths available for vessels of varying size up to 800 feet (243m8) in length, and 35 feet (10m7) draught.

During the south-west monsoon, vessels secure head and stern between the buoys, heading westward, with their port anchors down.

If the harbour is congested some of the intervening half-berths between the berths in each line are used, vessels lying with both anchors down and their sterns secured to the stern buoys of the two neighbouring berths.

During the north-east monsoon, vessels secure head and stern between the buoys, heading northward, with their starboard anchors down in the western tier, or their port anchors down in the remaining tiers.

Vessels berthed in the eastern tier are supplied with extra stern springs by the Master Attendant, for the tending of which the vessel is responsible.

Vessels can approach their berths between any of the tiers.

Men-of-war are berthed, when berthing conditions admit, in the western tier.

Two mooring-buoys, for the use of vessels carrying explosives, are situated about three-quarters of a cable south-south-westward of the northern extremity of Island breakwater (*Lat. 6° 58′ N., Long. 79° 51′ E.*).

There are several berths for small vessels along the southern and eastern sides of the harbour. Vessels secure their sterns to the buoys and lie to either one or two anchors, heading according to the monsoon.

Native craft are berthed on the southern side of the harbour inside the berths for small vessels; they lie to their own ground tackle.

A *red fixed* light is exhibited from certain of the mooring buoys near the harbour entrances when these berths are unoccupied.

A pair of leading lights is established on the southern side of the harbour. The front light is exhibited, at an elevation of 58 feet (17m7), from a black beacon situated about one cable eastward of the head of Patent Slip jetty; the rear light is exhibited, at an elevation of 73 feet (22m3), from a clock tower about 1¾ cables southward of the front light. These lights in line, bearing 190°, lead between the second and third lines of mooring buoys reckoned from eastward.

Caution.—All vessels in Colombo harbour, after they have been moored to the satisfaction of the Master Attendant, are responsible for tending their own mooring hawsers.

Charts 3686, 3700, 68b, 813, 828, 2898, 70, 748b.

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Chart 914.

Harbour signals.—The following special signals are in use in Colombo harbour (*Lat. 6° 57′ N., Long. 79° 51′ E.*):—

By day (*Flags are from the International Code of Signals*)	*At night.*	*Signification.*
Red ball . .	*Red fixed* light	Shown from the pilot station flagstaff (*see* page 113) when vessels are required to run out extra mooring ropes to the buoys and prepare to let go a second anchor.
Flags KXR . .	—	Displayed from the pilot station flagstaff when weather conditions are such as to preclude vessels being boarded by the pilot outside the harbour.
—	Alternate *red* and *white* flashes	Shown from pilot station indicates that a pilot is coming off now.
—	A series of *red* flashes	Shown from the pilot station indicates that the pilot is engaged and will come off when disengaged.
—	A series of long *white* flashes	Shown from the pilot station signifies: Pilot cannot come off. Anchor or remain off the port till daylight.
Flags NQ . .	Three *red* lights, vertically disposed 6 feet (1m8) apart, hoisted where best seen	Shown by a vessel indicates that she is on fire. *Note:* Attention may be called to this signal by the continuous sounding of any fog-signalling apparatus.
Flag G. . .	Two *red* lights, vertically disposed	Shown by a vessel in harbour indicates that a pilot is wanted.
Flags ST . .	*White, red* and *white* lights, vertically disposed.	Shown by a vessel indicates that the police are wanted.
Flag W . .	*Red, white* and *red* lights, vertically disposed.	Shown by a vessel indicates that the port surgeon is wanted.
Flag N . .	Two *white* lights, vertically disposed.	Vessel ready to work cargo.
Flags QN . .	Three *white* lights, vertically disposed.	Shown by a vessel indicates that empty lighters are wanted.
Flags CWF . .	—	Shown by a vessel indicates that cargo is wanted.
Flag Q . .	Two *white* lights, vertically disposed.	Shown by a vessel indicates that pratique is requested.
—	*Red* and *white* lights, vertically disposed	Exhibited by a vessel indicates that she has not yet received pratique.
House flag under ensign at stern	*White* light under stern light	Shown by a vessel to which "Restricted pratique" has been granted.
One long blast on siren followed by *four short* blasts.	—	Signal for tug.
	Note: This sound signal is only to be used in case of emergency.	

Man overboard.—Any vessel observing that a person has fallen overboard from any ship, boat, lighter or other craft should make the following signals:— 5

By day. — (i) Hoist International Code Flag O and haul it up and down to attract attention.

(ii) Sound short blasts on the siren or whistle.

At night.— (i) Flash the letter O in Morse code in the direction of the pilot station. 10

(ii) Sound short blasts on the siren or whistle.

Note.—The above signals will be observed by either the pilot

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Chart 914.

station (*Lat. 6° 57′ N., Long. 79° 51′ E.*) ,the Harbour police or the Port fire brigade, and a motor-boat will then be despatched to the scene.

Floating crane.—When a large red flag is displayed on a floating crane engaged on new construction work, all vessels passing or in the vicinity are to proceed at such a speed that they cause no wash or any kind of disturbance affecting the crane.

Quarantine.—The appropriate quarantine signal (page 117) is to be displayed by all vessels arriving in the harbour and no person except the pilot is allowed to board or to leave the vessel until pratique is given.

Vessels having, or having had within ten days previous to arrival any infectious disease, are placed in quarantine for a period decided by the Chairman of the Board of Immigration and Quarantine. In such a case, the vessel may have to anchor in the roadstead or other place as directed by the Master Attendant.

Vessels in quarantine must display the necessary signals, *see* page 29.

Vessels discharging dangerous oil.—To avoid risk of fire or accident, vessels discharging dangerous petroleum are surrounded, at a distance of not less than 100 feet (30^{m}5), by a rope boom floated on red wooden buoys and displaying:—

(*a*) By day, a red flag over a green flag.

(*b*) At night, four lights, *red* and *green* alternately, vertically disposed.

Charts 914, 3686.

Colombo.—The town of Colombo was originally founded as a European settlement by the Portuguese, who arrived here with a fleet of 19 ships, under Lopez Suarez Albergaria, in 1518, and erected a fort. The Sinhalese name Kolamba was modified by the Portuguese to Colombo, possibly in honour of Columbus. Colombo, together with the maritime provinces of Ceylon, fell into the hands of the Dutch in May 1656, and was surrendered to the British in February 1796.

What may be called the old town of Colombo consists of The Fort and the Pettah or native town; this forms only a small part of the present city of Colombo which extends both northward and southward from the old town.

The Fort (*Lat. 6° 56′ N., Long. 79° 51′ E.*), so called on account of the old Portuguese and Dutch fortifications which entirely encircled it in former days, but are now removed, is laid out as a modern European town, in which are the Governor General's residence (Queen's house), Government offices and the clock tower which stands on the highest part.

In the Pettah, separated from and situated eastward of The Fort, are the Town hall and municipal offices; in the district known as Hulftsdorp are the Law courts and All Saints church with a tall conspicuous spire. About 3½ cables northward of the latter is Wolfendahl Presbyterian church with a white conical dome, which is prominent from most parts of the harbour; in this church are the tombs of several of the Dutch governors.

Mutwal suburb stretches from the northern part of the native town almost to the southern bank of Kelani ganga, and contains Christchurch cathedral with a square tower, situated about 1¼ cables southward of the dry docks, and St. Lucia's cathedral (*see* page 112).

Charts 3700, 68b, 813, 828, 2898, 70, 748b.

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Charts 914, 3686.

Southward of The Fort is Galle Face, a fine esplanade, and Slave island, the military headquarters.

The population, in 1953, was 426,127.

Trade.—Shipping.—The principal exports are tea, coffee, cinnamon, areca nuts, coconut oil, coir, plumbago, copra and coconuts; the chief imports are coal, machinery, hardware and rice.

In 1959, 2,525 vessels of a gross tonnage of about 16,518,142 entered the port.

Port facilities.—A large stock of fuel oil and coal is maintained.

Fuel oil can be supplied to vessels alongside at rates of from 150 to 100 tons per hour. Vessels not desiring to go alongside can be supplied from lighters.

Coal is supplied by manual labour from lighters; the average rate of supply is about 500 tons per day.

Fresh provisions are plentiful. Fresh water can be supplied from hydrants at the main alongside berths and dry docks, also by water lighters of which there are about 30.

There are two dry docks for the dimensions of which *see* Appendix I on page 343. There is also a patent slip with a capacity of 200 tons.

All repairs to vessels can be undertaken. There are a large number of cranes, the largest of which has a lifting capacity of 30 tons, and two 60-ton floating cranes. Divers can be obtained and fire-fighting and salvage appliances are available.

There are five tugs exceeding 1,200 H.P. and nine exceeding 100 H.P. About 350 cargo lighters with capacities of from 35 to 100 tons are available. For the emergency signal for a tug *see* page 117.

Seamen are admitted to a general hospital at Maradana, situated about 2 miles south-eastward of Colombo lighthouse. An ambulance launch is available.

The offices of the Port Commission and of the Master Attendant are situated in the Port Commission building at the root of Delft pier. There is a shipping office and a sailor's home in the town.

Deratisation.—Deratisation can be carried out and Deratisation Exemption certificates issued; *see* page 29.

Life-saving.—3 power lifeboats are maintained and 3 life-saving tugs are normally available.

Communications.—Radio stations.—Radiobeacon.—There is regular sea and air communication between Colombo (*Lat. 6° 56′ N., Long. 79° 51′ E.*) and all parts of the world.

There is railway communication with Kandy and with the principal towns on the coast of Ceylon.

A coastal radio station is situated in the town, about 3½ cables east-south-eastward of Colombo lighthouse.

There is also a radio station at Welikada, about 2½ miles south-eastward of the harbour, *see* page 24. A radiobeacon transmits from this radio station.

Climatic table.—*See* page 45.

Charts 914, 3686, 68b.

NORTH-EASTERN SIDE OF GULF.—Coast.—Dangers.—Light.—Beacon.—Buoy.—From Mutwal point at the northern end of Colombo harbour the coast takes a general northerly direction for about 14½ miles to Negombo point.

Charts 3700, 68b, 813, 828, 2898, 70, 748b.

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Chart 914.

On the north-eastern side of Mutwal point is a fishery harbour, protected from the westward by a rubble breakwater.

A light is exhibited from an iron column on the northern extremity of this breakwater.

The entrance to Kelani ganga is about three-quarters of a mile north-eastward of Mutwal point (*Lat. 6° 58′ N., Long. 79° 51′ E.*); the sandy entrance points are constantly changing their shape. This river is always difficult to enter on account of the swell and foul ground, and the entrance is sometimes blocked by sand; the entrance channel has a least depth of 3 feet (0m9) in its fairway.

Charts 914, 3686, 68b.

For about 5 miles northward of the entrance to Kelani ganga the coast consists of a sandy beach, thickly fringed with coconut trees, behind which are two canals, communicating with Negombo, a town abreast Negombo point. There are some bungalows on this part of the coast.

Chart 3686.

A white concrete beacon, 20 feet (6m1) high, is situated near the coast, about 2¼ miles northward of the entrance to Kelani ganga.

From about 3 cables east-north-eastward of Mutwal point, Kalapu gala, a narrow reef of gneiss rock, extends for about 4 miles in a northerly direction, at a distance of about half a mile offshore; there are several rocky heads on this reef with depths of less than 6 feet (1m8) over them. The sea breaks over Kalapu gala during the south-west monsoon, and blind rollers occur in calm weather.

Chart 68b.

Kepungoda church (*Lat. 7° 07′ N., Long. 79° 50′ E.*), with a red roof and low twin towers, is situated on the coast, about 8¼ miles northward of the entrance to Kelani ganga; this building, together with the school house, one cable north-north-westward of it, is prominent.

Negombo lagoon, entered close eastward of Negombo point through a narrow channel, extends for about 7 miles south-south-eastward from the point. The town of Negombo, where the twin towers of St. Mary's church form a prominent landmark, is situated at the northern end of the lagoon.

A narrow reef, the southern end of which is situated about 2 miles north-north-westward of Negombo point, has a least depth of 1¼ fathoms (2m7) over it.

The entrance to Maha oya is about 4 miles north-north-eastward of Negombo point, and causes a break in the line of coconut trees which fringes the coast.

From the entrance to Maha oya the sandy coast has a northerly direction for about 20 miles to Chilaw point, and is unbroken; this coast is featureless, the most conspicuous object being a single banyan tree near Marawila, a village about 8 miles northward of the entrance to Maha oya.

A red can buoy is moored about 3½ miles west-south-westward of Chilaw point.

The town of Chilaw lies about 1¼ miles south-south-eastward of Chilaw point, on the eastern bank of a narrow estuary, extending from Chilaw lake, which runs parallel to and very near the coast, and which has a common mouth with Deduru oya at Chilaw point.

There are several bungalows on the coast, abreast the town of Chilaw.

Charts 828, 2898, 70, 748b.

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Chart 68b.

Chilaw point (*Lat. 7° 36′ N., Long. 79° 48′ E.*) can be identified by a sandhill with a round hummock near it.

Charts 3686, 68b.

Off-lying dangers.—Light-buoy.—Ona gala, the southern end of which is situated about 2 miles north-westward of Mutwal point and the light-buoy off its southern end are described on page 112.

A shoal, with a depth of 7¾ fathoms (14m2), extends over 3 miles northward, from a position about 8½ miles west-south-westward of Negombo point. This shoal was unexamined in 1944.

Chart 68b.

Anchorages.—There is anchorage, except during the south-west monsoon, about one mile westward of the narrow reef 2 miles northward of Negombo point (*see* above), in depths of about 7 fathoms (12m8).

Small vessels with local knowledge can anchor eastward of this reef, about half a mile offshore, in a depth of about 3½ fathoms (6m4).

There is anchorage for small vessels near the mouth of Chilaw estuary, about 1¾ miles north-westward of Chilaw point, in a depth of 6 fathoms (11m0). Vessels making this anchorage from the southward should keep from 4 to 5 miles offshore, and close the land as Chilaw point is neared.

Coast.—Dangers.—Beacon.—From Chilaw point the coast is formed by a narrow peninsula extending northward for about 45½ miles. The southern part of this peninsula is separated from the mainland by a narrow channel, which extends northward from the mouth of Deduru oya for a distance of about 9 miles to Mundel (Mundal) lake.

A considerably wider channel, about 7½ miles in length, and in which there are several islets, connects the northern end of Mundel lake to Puttalam lagoon, which extends for about 17 miles northward.

The town of Puttalam lies on the south-eastern side of Puttalam lagoon, and the town of Kalpitiya is situated on the western side of the narrows at the northern end of the lagoon.

A reef, above and below water, is situated about 3½ miles northward of Chilaw point and about half a mile offshore.

From the coast, abreast Mampuri, a town situated on the south-western shore of Puttalam lagoon, a shallow flat of rock and sand extends south-westward for about 7 miles. On this flat, about 4 miles west-south-westward of Mampuri (*Lat. 8° 00′ N., Long. 79° 44′ E.*) and about 3½ miles offshore, is a 2-fathom (3m7) shoal; this shoal is particularly dangerous as there are depths of over 100 fathoms (182m9) about 1¼ miles seaward of it.

Vessels passing the peninsula described above should keep about 7 miles offshore, and in depths of over 20 fathoms (36m6), to avoid the above-mentioned flat.

Charts 68b, 68a.

The northern 3 miles of the peninsula consist of a sand spit, which, in 1955, was reported to have extended one mile further north-north-eastward than charted. From the northern extremity of this spit a bank, with depths of less than 3 fathoms (5m5), extends about 17 miles northward, with Cheval bank (page 123) lying a further 2 miles northward.

Karaitivu island lies on the above bank with its southern extremity 2 miles north-eastward of the northern extremity of the peninsula; it is a long strip of low land with some sand hillocks on it through which the

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Charts 68b, 88a.

sea has forced a breach about 2 miles from the southern end, dividing the island into two parts.

The shoal water between Karaitivu island and Cheval bank has not been completely examined, and, in 1928, was reported to be shoaling. *Chart 68b.*

Within the 6-fathom (11m0) line westward of the northern part of the peninsula and the bank extending northward from it the depths are irregular and there are a number of patches, as indicated on the chart, with depths of from 1½ to 3 fathoms (2m7 to 5m5). Bar reef, which dries, lies in this area about 2 miles north-westward of the northern extremity of the peninsula.

Dutch bay, which is entered between the sand spit mentioned above and the southern end of Karaitivu island, is shallow and lies eastward of the northern part of the peninsula. It contains several low-lying islets including Ippantivu, which lies 2 miles southward of Karaitivu with Periya Arichchal, Sinna Arichchal and Erumativu islets one mile, 2¼ and 3¼ miles, respectively, south-south-westward of it; Ippantivu is covered with palm trees and is prominent.

Portugal bay, lying eastward of Karaitivu island, is shallow.

A white masonry tower, known as Aruakalu tower, stands on the summit of a 260-foot (79m2) hill situated about 4½ miles east-north-eastward of Kalpitiya.

Kudremalai point, about 5½ miles eastward of the northern extremity of Karaitivu island, is steep and rocky; there are three long sand mounds southward of the point; on the highest of these mounds stands a white masonry tower, 225 feet (68m6) high and known as Kudremalai tower.

A beacon, 125 feet (38m1) high, stands on Kudremalai point (*Lat. 8° 32′ N., Long. 79° 52′ E.*); it consists of a black iron tripod, with a diamond-shaped topmark.

Anchorages.—There is good anchorage for vessels of a draught not exceeding 14 feet (4m3) about one mile westward of the northern extremity of the peninsula on which is the town of Kalpitiya.

Small vessels with local knowledge can obtain anchorage, sheltered from south-westerly winds, in Dutch bay.

Portugal bay affords anchorage to small vessels with local knowledge, with sheleter from south-westerly winds, in depths of 3 fathoms (5m5).

Vessels of a draught not exceeding 14 feet (4m3) can obtain good anchorage about 2 miles westward of Kudremalai tower in charted depths of from 3¼ to 3¾ fathoms (5m9 to 6m9).

Coast.—Dangers.—Beacons.—Obstruction.—Buoy.—Between Kudremalai point and Moderegam point, about 4 miles north-eastward, the coastline forms a bay; Uppu aru flows into the sea, about 3½ miles east-north-eastward of Kudremalai point.

A white masonry obelisk, 95 feet (29m0) high, stands on the coast, about half a mile northward of the mouth of Uppu aru; in the afternoon it is visible from the westward at a distance of 15 miles.

The village of Marichchukkaddi lies about 1½ miles inland, eastward of this beacon; from time to time during the season, i.e., March and April, this village is the centre of the pearl-fishing industry, but at other times it is of little importance.

Two 3-fathom (5m5) shoals lie about 3¼ miles offshore, westward of Moderegam point.

Charts 828, 70, 748b.

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Chart 68b.

The shoal water extending northward from Karaitivu is described on page 122.

Charts 68a, 68b.

Kal aru flows into the sea, about 4 miles north-north-eastward of Moderegam point; there is a white masonry obelisk on the northern entrance point of this river (*Lat. 8° 39′ N., Long. 79° 57′ E.*).

Between Moderegam point and the mouth of Kal aru shoal water, with depths under 6 fathoms (11m0), extends for about 12 miles offshore.

Cheval bank, situated about 8½ miles northward of Karaitivu and about 10 miles offshore, has a least depth of 2½ fathoms (4m6).

In 1958, a submerged obstruction, dangerous to navigation, was reported on Cheval bank; it was marked by a can buoy which, however, was unreliable.

Chart 68a.

Between the mouth of Kal aru and the mouth of Aruvi aru, about 9 miles northward, the coast is low and sandy; there are mounds of oyster shells along this coast.

The village of Kondachchi is situated on the coast, about 3½ miles northward of the mouth of Kal aru.

A white masonry tower, known as Doric beacon, is situated on the coast, about 4 miles north-north-westward of Kondachchi; it is prominent during the afternoon.

Aruvi aru flows into the sea by several mouths close northward of a village, named Arippu; between the outer part of its delta and the south-eastern end of Mannar island, about 8½ miles north-north-westward, the coastline forms a bay, in which the depths do not exceed 2 fathoms (3m7).

A lake, known as Giant's tank, is situated inland about 7 miles north-eastward of Arippu.

The pearl banks, with depths of less than 6 fathoms (11m0), lie in the bight between Kondachchi and Adam's Bridge, about 28 miles north-westward; they extend up to about 10 miles offshore and there are depths of 3 fathoms (5m5) about 5 miles offshore in the vicinity of the delta of Aruvi aru, and about 10 miles offshore in the vicinity of the south-eastern end of Mannar island.

About 2½ miles westward and north-westward of Kondachchi are several rocks, nearly awash.

Silavatturai reef, the south-eastern end of which is situated about 3½ miles west-north-westward of Kondachchi (*Lat. 8° 43′ N., Long. 79° 57′ E.*) and about 3 miles offshore, has depths of less than 6 feet (1m8) over it.

Arippu reef, the south-eastern end of which is situated close north-westward of Silavatturai reef and about 3½ miles offshore, has depths of less than 6 feet (1m8) over it, and is marked at its northern end by a black beacon, about 52 feet (15m8) in height; this beacon consists of an iron tripod, with a diamond-shaped topmark.

Vankalai reef, the south-eastern end of which is situated about 4¾ miles north-westward of Arippu Reef beacon and about 7½ miles offshore, dries at its south-eastern end.

Charts 68a, 68b.

Anchorage.—Caution.—Small vessels can obtain anchorage from 2 to 3 miles westward of the beacon close northward of the mouth of

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Charts 68a, 68b.

Uppu aru in depths of from 3 to 4 fathoms (5m5 to 7m3). Vessels should approach this anchorage by passing northward of Cheval bank.

It is not advisable to close the Ceylon coast when northward of Karaitivu on account of the extensive shoal banks in this vicinity.

Owing to the existence of several unchartered coral heads, with a depth of less than 2 feet (0m6) over them, great caution should be exercised when navigating in depths of less than 3 fathoms (5m5), for a distance of about 10 miles northward of Moderegam point.

Chart 68a.

NORTHERN SIDE OF GULF.—Mannar island.—Lights.—Mannar island is separated from the mainland of Ceylon by a boat channel which is crossed by a conspicuous railway bridge and a road bridge, and has a bar at either end. The port of Mannar, situated on the north-western side of the channel, affords shelter to small vessels with local knowledge; a Customs officer at each bar examines vessels entering. The town of Mannar, situated at the head of the port, is surrounded by coconut trees.

The island is wooded and has low sandhills on its south-western side for a distance of about 5 miles from its south-eastern end; at the western end there are coconut and other palms near the villages.

A disused lighthouse, consisting of a black steel framework tower, 92 feet (28m0) high and conspicuous, stands on the western extremity of Mannar island.

Talaimannar (*Lat. 9° 06′ N., Long. 79° 43′ E.*) is situated at the western end of Mannar island; it is connected to the railway system of Ceylon. Steamers run between this place and Dhanushkodi, the terminus of the South India railway, situated on Pamban island, about 2 miles from the western end of Adam's Bridge.

A light is exhibited, at an elevation of 55 feet (16m8), from a white concrete tower, 64 feet (19m5) in height, situated at the root of the pier at Talaimannar.

A light is occasionally exhibited, at an elevation of 25 feet (7m6) from an iron column, 20 feet (6m1) in height, situated on the head of the pier at Talaimannar.

Anchorages.—Anchorage can be obtained in a depth of 3 fathoms (5m5), mud, about 2¼ miles from the south-eastern side of Mannar island with the conspicuous railway bridge between Ceylon and Mannar island bearing 099° distant about 5 miles.

There is good anchorage, during the north-east monsoon, for a vessel drawing not more than 14 feet (4m3), about 3¼ miles southward of Talaimannar lighthouse.

Adam's Bridge.—Adam's Bridge is a narrow ridge of sand and rocks, mostly dry, which connects Mannar island with Pamban island about 15½ miles west-north-westward; it is mostly composed of shifting sandbanks, with intricate channels between them, in which the depths vary, but may be from 3 to 4 feet (0m9 to 1m2).

There are depths of over 100 fathoms (182m9) about 12 miles south-westward of Adam's Bridge; within this distance the depths decrease rapidly, and shoal water, with depths under 6 fathoms (11m0), extends in places to a distance of 5 miles from the ridge.

A 5½-fathom (10m1) shoal is situated about 18½ miles westward of

Charts 828, 70, 748b.

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Chart 68a.

the disused lighthouse on the western extremity of Mannar island, and about 5½ miles from Adam's Bridge.

From about 11½ to 18 miles westward of the disused lighthouse on Mannar island and lying about 1½ miles off the southern side of Adam's Bridge are some detached shoals, with depths of from 1¾ to 3 fathoms (3m2 to 5m5). The western of these shoals is Margarita shoal with a least depth of 1¾ fathoms (3m2).

Current.—In the south-west monsoon a strong current sets northward over Adam's Bridge, but abates to the westward as the Indian coast is neared. A confused sea generally prevails near Mannar island.

Pamban island.—Beacons.—Pamban island, the south-eastern extremity of which is known as Lands End, lies between Adam's Bridge and Ramen point, a narrow tongue of land on the mainland, about 16 miles west-north-westward; it is low and sandy and covered with scrub and stunted bushes; it is well planted with coconut trees towards its western end, where a broad peninsula extends for about 3 miles north-eastward; the northern extremity of this peninsula is known as Devil's point. Owing to the prevalence of malarial fever Pamban island cannot be considered healthy, but the climate is salubrious.

Chuttram (*Lat. 9° 11′ N., Long. 79° 25′ E.*), about 1¾ miles north-westward from Lands End, is situated amongst a clump of palm trees, about 75 feet (22m9) high, which enables it to be easily identified from seaward.

The red-roofed railway buildings of Dhanushkodi, which lies close north-westward of Chuttram, are prominent. There is also a small prominent building on the extremity of Lands End.

A white beacon stands on the south coast of Pamban island about 3 miles west-north-westward of Lands End.

Rameswaram temple, 164 feet (50m0) high and situated in the town of that name on the south-eastern side of the broad peninsula mentioned above, is conspicuous. It appears as a large square tower when viewed from north-eastward or south-westward, and as a narrow pinnacle when viewed from north-westward or south-eastward.

Charts 3581, 68a.

Gandhamana temple, less conspicuous than Rameswaram temple, though the two are often confused, is situated in the centre of the peninsula about one mile north-westward of the latter. The temple stands in an enclosure, which is entered by a gateway 100 feet (30m5) in height, and is visited by large numbers of pilgrims from India. Its towers are 145 feet (44m2) in height. A large clump of trees, 107 feet (32m6) high, stands about three-quarters of a mile eastward of the temple.

South East Port beacon, 16 feet (4m9) high and painted white, is situated on the southern side of Pamban island, about 12½ miles west-north-westward of Lands End; another beacon, 11 feet (3m4) high, stands about 3 cables within Kundagal point, the south-western point of the island, about 2 miles west-south-westward of South East Port beacon.

Kundagal point, on which are the ruins of some workshops and a patent slip, is a low sandy point, but coconut plantations commence a short distance inland, and extend northward and north-eastward; a

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Charts 3581, 68a.

beacon, consisting of a wooden pole, stands on the spit which extends about 2 cables eastward from Kundagal point.

Chart 3581.

Off - lying islets and dangers. — Beacons. — Buoyage.— Mansfield patch, about 7 miles south-eastward of Kundagal point (*Lat. 9° 15′ N., Long. 79° 13′ E.*) and about 4 miles offshore, is the northern and shoalest of a group of detached patches which lie close together; it has a least depth of 19 feet (5m8).

Arundel shoal, lying about 8½ miles south-south-eastward of Kundagal point and about 7½ miles offshore, consists of coral patches, with a least depth of 28 feet (8m5).

Batt patch, about 5¼ miles south-south-eastward of Kundagal point and about 5 miles offshore, has a least depth of 16 feet (4m9); it is the shoalest head of a group of detached patches which extends about one mile south-eastward and 2 miles westward from it; the sea breaks on Batt patch in a fresh breeze.

A 28-foot (8m5) shoal is situated about 6¾ miles southward of Kundagal point.

A 19-foot (5m8) shoal lies about 5½ miles south-south-westward of Kundagal point.

A black can light-buoy, exhibiting a *white flashing* light *every six seconds*, is moored about 5½ miles south-south-westward of Kundagal point, and about 1¼ miles east-south-eastward of the above 19-foot (5m8) shoal.

Charts 3581, 68a.

Manauli shoal, situated about 7¼ miles south-westward of Kundagal point, has a least depth of 12 feet (3m7).

A 3-fathom (5m5) shoal lies about three-quarters of a mile west-south-westward, and two similar patches lie about 5 and 9 cables east-north-eastward, of Manauli shoal.

A large coral reef, known as Manauli reef, lying with its eastern extremity about 4 miles south-westward of Kundagal point (*Lat. 9° 15′ N., Long. 79° 13′ E.*), dries in patches. New islet, Manauli island and Musal tivu are situated on the reef about 1½, 2 and 4¼ miles, respectively, from its eastern end. A conspicuous white beacon stands close eastward of Manauli island.

Chart 3581.

Pulli shoal, the western end of which is situated about 2¾ miles eastward of Manauli island, has a least depth of 4 feet (1m2); the sea breaks over this shoal.

Between Manauli reef, the eastern side of which is marked by beacons and by a can buoy, painted black and white in chequers, and Pulli shoal is Puma channel.

An isolated shoal, with a depth of 17 feet (5m2), lies in the southern approach to Puma channel, about 6 cables south-westward of the western end of Pulli shoal. It is marked by a red conical buoy on its western side.

A black can light-buoy, exhibiting a *white flashing* light *every three seconds*, is moored about one mile south-westward of Pumurichan beacon, described below.

A coral reef, known as Pulli reef, the western end of which is situated about 3 miles east-north-eastward of Manauli island, dries in patches. Its northern edge is clearly defined at low water, but its southern edge

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Chart 3581.

is much indented and the sea breaks on it. The north-western and southern sides of the reef are marked by beacons.

Pumurichan, the southern extremity of which is about 3¼ miles east-north-eastward of Manauli island, is an island lying on the western side of Pulli reef. On its south-western side there is a conspicuous beacon, 32 feet (9m8) high.

Pumurichan tivu (Pullivausel) lies on the south-western side of Pulli reef, close south-eastward of Pumurichan.

A third island, known as Kurisadi tivu, lies on the eastern side of Pulli reef. Bushy point, its south-western extremity, lies close northward of the north-eastern extremity of Pumurichan tivu, and Sandy point, its south-eastern extremity, lies about half a mile south-south-eastward of Kundagal point (*Lat. 9° 15′ N., Long. 79° 13′ E.*). There is a fishery research station, occupying the rebuilt ruins of a hospital, situated near its eastern end. A pier projects from the island, near the research station, with a depth of 4 feet (1m2) at its head. It should be approached from the westward.

Pumurichan and Pumurichan tivu are covered with scrub and bushes, but Kurisadi tivu is largely planted with palmyra and coconut trees.

Kurisadi beacon, No. 2, 24 feet (7m3) high, is situated in the centre of Kurisadi tivu, about 4½ cables from Sandy point, and Kurisadi beacon, No. 1, 15 feet (4m6) high, on the northern edge of Pulli reef about 1½ cables north-westward of No. 2 beacon.

Kallaru reef, the western extremity of which is situated about 5¾ cables south-eastward of Sandy point, is of coral formation. Shingle island, which is low and has bushes and shrubs on it, stands on this reef, on the south-western edge of which the sea breaks heavily.

A conspicuous, triangular beacon, 31 feet (9m4) high, painted white with a black horizontal band, stands on the eastern point of Shingle island.

There are some shoals, with a least depth of 17 feet (5m2), lying about one mile eastward of Shingle Island beacon; these shoals are in the fairway of the eastern approach to Kundagal channel, the channel northward of Kallaru reef into Kundagal gut, which lies between Kundagal point and the northern side of Kurisadi tivu.

Light.—Storm signals.—A light is exhibited, at an elevation of 94 feet (28m7), from a white masonry tower, 67 feet (20m4) in height, situated on a sandhill on the north-western point of Pamban island.

Storm signals are displayed from a flagstaff close to this lighthouse; the general system is used. *See* also page 20.

Pilots.—Pilotage is compulsory for merchant vessels. The licensed pilots at Pamban are under the orders of the Pamban Port Conservator.

Pilots are stationed at Kundagal point, Mundel point (at the western extremity of Pamban island) and on the northern side of Pamban pass, to look out for vessels approaching Pamban. There are no official signals for vessels requiring a pilot, but local craft usually display a red or white flag.

Tidal treams.—The tidal stream sets through Kundagal channel in a westerly direction with the flood tide, and from thence westward along the northern edge of Pulli reef, where it meets the flood tidal stream setting in a north-westerly direction through Puma channel;

Charts 68a, 828, 70, 748b.

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Chart 3581.

these streams then combine and set in a northerly direction, but they are weak unless influenced by strong southerly winds.

Anchorages.—Vessels can anchor in Kundagal channel in depths of from 19 to 23 feet (5m8 to 7m0). Small vessels can anchor westward of Kundagal gut (*Lat. 9° 15′ N., Long. 79° 13′ E.*), with protection in all weathers, in depths of from 7 to 8 feet (2m1 to 2m4).

Pamban pass.—Bridge.—Signals.—Pamban pass is the navigable channel, partly artificial, through the banks which occupy the space between the western end of Pamban island and the mainland; it is well marked with beacons, and is easy to navigate.

In 1958, there was a least depth of 7 feet (2m1) in the pass and the maximum draught of vessels using it was 10½ feet (3m2), but the pilots prefer not to pilot vessels of over 9½ feet (2m9) draught. It was planned to dredge the channel to a depth of 10 feet (3m0) during 1958.

The pass is of great advantage to native coasting craft trading between ports on the west coast of India and those of the Bay of Bengal; it is also used by some small coasting vessels of from 200 to 800 tons and about 200 feet (61m0) in length, but these are as large as can be safely navigated.

A narrow tongue of land, named Thonithorai, about 9½ cables west-north-westward of the western extremity of Pamban island, projects eastward from the mainland coast. Thonithorai temple, now in ruins, stands about one cable within Ramen point, its eastern extremity, and about the same distance farther westward is a prominent, though sparse, plantation of coconut trees.

South Toni beacon, painted white and 24 feet (7m3) high, stands about 6½ cables westward of Ramen point.

Between the west coast of Pamban island and Ramen point, a rocky barrier extends in a nearly straight line; Pamban viaduct, which carries the South India railway, is built on this barrier.

About a quarter of a mile westward of Pamban is a cutting, 200 feet (61m0) wide, through the rocky barrier; a rolling lift-bridge is constructed over the channel to permit vessels to pass through. The bridge is under the control of the Port Conservator, who will cause it to be opened when half an hour's notice is given; in an emergency it can be opened immediately. In 1958, it was reported that the bridge was opened only twice a day between 0800 and 1000, and 1600 and 1800. Flag P of the International Code of Signals is displayed from the port offices flagstaff to denote that the bridge is fully open; displayed from the northern yardarm this flag denotes that vessels from northward may pass through, and from the southern yardarm, that vessels from southward have priority.

On the western side of the pass the barrier is named The Great Dam, and consists of large masses of rock, having a flat surface, which were formerly portions of a causeway that extended from Pamban island to the mainland. The northern face of the dam is steep-to at low water, and presents a wall-like appearance, but the boulders are sufficiently separated to allow a free passage to the water at low tide. About 1½ cables eastward of Ramen point there is an opening in the rocks; it is, however, so small, and has such a rush of water through it, that even fishing canoes never attempt to pass through.

About half a cable southward of The Great Dam, and parallel to it, is South Dam, another ridge of rock and coral, which partially dries,

Charts 68a, 828, 70, 748b.

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Chart 3581.

and extends from the pass half-way to Thonithorai (*Lat. 9° 17′ N., Long. 79° 11′ E.*).

Eastward of the pass is a ledge of rocks, evidently once a continuation of The Great Dam; it dries, and there are several patches of rock southward of it, with varying depths between.

Pulli reef forms a natural breakwater, protecting Pamban pass and the channels leading to it from the swell of the south-west monsoon.

The northern approach to Pamban pass and the adjacent coasts are described in the Bay of Bengal Pilot.

Currents.—Tidal streams.—The currents set southward during the north-east monsoon and northward during the south-west monsoon; their rate is proportionate to the wind, 5 to 6 knots being frequently attained; this makes the passage of the pass difficult at times, even for powered vessels.

Definite tidal streams are only noticeable during the months of March, April and October, when they generally set through the pass for 6 hours in each direction.

Horseshoe bank.—From the western end of Pamban island, which terminates at Mundel point, an extensive sandbank, known as Horseshoe bank on account of its shape, on which the depths do not exceed 6 feet (1^{m}8), extends in a south-westerly direction nearly as far as the northern extremity of Pulli reef and thence northward to Thonithorai.

Through the south-eastern part of this sandbank is Sand Bank channel, with a depth, in 1943, of 7 feet (2^{m}1) in it. Its south-eastern entrance lies about one mile west-north-westward of Kundagal point.

The continuation of Sand Bank channel north-eastward is a narrow channel, known as The Basin, which passes between the sides of the Horseshoe; this latter channel has depths of from 15 to 22 feet (4^{m}6 to 6^{m}7) in the fairway.

About one mile westward of Kundagal point is another channel, which passes between the southern side of Horseshoe bank and the northern edge of Pulli reef; this channel had, in 1943, a depth of 11 feet (3^{m}4) in it.

Buoys and beacons.—Besides the beacons on the drying reefs described on pages 126-127, there are several buoys and beacons marking the channels leading to Pamban pass.

As already stated, a beacon marks the edge of the spit extending about 2 cables eastward from Kundagal point (*Lat. 9° 15′ N., Long. 79° 13′ E.*), at the eastern entrance to Kundagal gut.

A beacon stands about 3 cables eastward of the eastern entrance to the channel passing along the northern edge of Pulli reef; there is a sunken rock about 1½ cables south-south-westward of this beacon.

A spherical buoy, painted red and white in horizontal bands, is moored about 7½ cables west-north-westward of Kundagal point and in the approach to Sand Bank channel.

Sand Bank channel, The Basin and the channel between Horseshoe bank and Pulli reef are marked by beacons, as shown on the chart.

Elbow buoy, a red conical buoy, is moored on the eastern side of the channel, at the junction of Sand Bank channel and The Basin, about 1¼ miles west-north-westward of Kundagal point.

Beacons mark the edges of the channel over a distance of 1¾ cables on either side of the bridge.

Charts 68a, 828, 70, 748b.

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Charts 3581, 68a.

Directions.—Caution.—Pamban pass may be approached from the south-eastward either by Kundagal channel and Kundagal gut, in which there is a least depth of about 14 feet (4m3) in the fairway, or from the south-westward by Puma channel; the former route is the better. There is also an approach through Kilakkarai passage, the inshore route westward of Thonithorai, but this is only suitable for very small craft with local knowledge.

When approaching Pamban from the southward caution is necesssry, as the islands fringing the coast are very low, and there are no hills or conspicuous landmarks; during the south-west monsoon a thick haze frequently hangs over and obscures these islands. Vessels of over 15 feet (4m6) draught should not approach within a depth of 8 fathoms (14m6) until their position has been accurately ascertained.

The first objects identifiable from seaward are Chuttram, with its clump of palm trees, Rameswaram and Gandhamana temples, Pamban lighthouse, the beacons on Manauli island, Pumurichan and Shingle island, a red square water tank on a framework structure, 58 feet (17m7) high, about one mile westward of Mandapam dry dock which is conspicuous, except from westward when bearing more than 050°, and the black can light-buoy moored about 5½ miles south-south-westward of Kundagal point.

Kundagal channel is the direct approach from the southward to Pamban pass. Vessels having passed the outlying dangers may steer towards the eastern entrance of Kundagal channel, passing about 4 cables eastward of Kallaru reef, and taking care to avoid the shoals eastward of Shingle island; when Kundagal beacon bears about 286° Kundagal gut may be steered for.

Kurisadi beacons, Nos. 1 and 2, in line astern, bearing 130°, lead through the fairway of Sand Bank channel, passing south-westward of the red and white spherical buoy and of Elbow buoy, and from thence vessels should keep south-westward of the leading line and close to the beacons marking the south-western side of the channel; thence they should steer in a north-easterly direction through the marked channel of The Basin, which connects with the southern end of Pamban pass.

Vessels making for Puma channel, which is only available for those with local knowledge, must be guided principally by the eye; Manauli reef is clearly visible, and the sea always breaks on its southern and eastern sides (*Lat. 9° 13′ N., Long. 79° 10′ E.*).

Chart 3581.

Mandapam South beacon, situated about 4½ miles westward of Pamban lighthouse and described below, in line with another beacon on a low hill, bearing 338°, leads through Puma channel, close to the red conical buoy between Manauli reef and Pulli shoal and the black can light-buoy south-westward of Pumurichan, and north-eastward of Cana Paru reef, the southern end of which is situated about 2 miles north-eastward of the eastern extremity of Manauli island; when the beacon on the south-western side of Pumurichan bears 060° vessels may steer north-eastward to pass through Puma East channel; the fairway of Puma East channel is marked by beacons in places, and has a least depth of about 13 feet (4m0). The greatest depth is on the southern side, close north-westward and northward of Pulli reef.

After passing through Puma East channel vessels should steer along

Charts 828, 70, 748b.

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Chart 3581.

the northern edge of Pulli reef into the channel between that reef and Horseshoe bank and thence into Sand Bank channel, and then follow the directions given above.

Vessels approaching the dry dock at Mandapam, described below, should pass through Puma channel as directed above and, after passing Cana Paru reef, should continue on the leading line until about 1¼ miles from Manapam South beacon, when a 10-foot (3m0) patch must be avoided; thence local knowledge is necessary.

Pamban.—The town of Pamban, which is connected with the general railway system, lies stretched along the north-western coast of Pamban island for about half a mile south-westward of the light-house; in 1951, the population was about 2,000, mainly labourers and fishermen.

The port is administered by a Conservator subordinate to the Port Officer at Nāgapattinam (Negapatam), and a Superintendent of Customs is stationed there. A few lighters of from 10 to 25 tons capacity are available, from which cargo is loaded and unloaded on the beach. Water can be supplied in 400-gallon casks in boats. In emergency, coal could be supplied by the South Indian Railway Company; when this is done it is put aboard in baskets at a rate of about 150 tons in 24 hours.

Climatic table.—*See* page 46.

Mandapam.—Beacons.—Facilities.—There is a dry dock at Mandapam, about 4 miles westward of Pamban lighthouse; for dimensions of this dock, *see* Appendix I on page 343.

Mandapam South beacon, 22 feet (6m7) high, stands about 5 cables westward of the dry dock; a white beacon, surmounted by a triangle, point down, stands on a low hill north-north-westward of Mandapam South beacon and in line with it, as mentioned above, it forms the leading marks for entry into Puma channel.

In an emergency a small quantity of coal could be supplied at Mandapam by the South India Railway Company. Small quantities of bread, meat and vegetables can also be obtained in an emergency.

About one mile westward of the dry dock is a quarantine camp, the water tank of which is conspicuous, as previously described.

Chart 68a.

Coast.—Dangers.—Beacons.—From Thonithorai (*Lat. 9° 17′ N., Long. 79° 10′ E.*) the coast trends in a west-south-westerly direction for about 32 miles to Valinokkam point, and is fronted by a chain of islets and shoals extending to distances of from 3 to 6 miles offshore; between this chain and the coast, and thus sheltered from the heavy seas during the south-west monsoon, is the shallow Kilakkarai passage (page 133).

Vedalai beacon, 19 feet (5m8) high, stands about 2 miles westward of Mandapam dry dock.

Muttupettai Betel is a village, in which there is a church, on the coast, about 16 miles westward of Thonithorai.

Two white leading beacons are situated on the coast, about 6½ miles west-south-westward of Muttupettai Betel.

Kilakkarai is a town on the coast, situated about 2 miles west-south-westward of the beacons just mentioned.

A reef-fringed point projects one mile from the coast, about 4½ miles south-westward of Kilakkarai; a sunken rock, marked by a beacon, lies about half a mile south-south-eastward of it.

A rock, with a depth of 1½ fathoms (2m7) over it, situated about

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Chart 68a.

1¼ miles north-north-eastward of Valinokkam point, is marked by a black iron beacon, 7 feet (2m1) high, surmounted by a broom.

A beacon-tower, 20 feet (6m1) in height, stands on Valinokkam point; it is a useful mark for vessels making the western entrance to Kilakkarai passage.

The town of Valinokkam is situated about half a mile westward of Valinokkam point, and on the shore of the bay north-westward of that point.

Between Valinokkam point and Vembar, about 18 miles west-south-westward, the coast is low, sandy and covered with palm trees.

Detached shallow flats, on some of which there are islands, lie at distances of from about one to 5 miles off this part of the coast.

Terku Mukkaiyur, about 10¾ miles westward of Valinokkam point (*Lat. 9° 09′ N., Long. 78° 40′ E.*), is a fishing village, in which is a church.

Between Vembar and Vaippar, about 7 miles south-westward, shoal water, with depths under 3 fathoms (5m5), extends for a distance of about 3½ miles offshore.

Two shoals, with least depths of 2½ fathoms (4m6) and 1½ fathoms (2m7), are situated about 4½ miles south-eastward and 4 miles southward, respectively, from Vembar.

Vaippar village lies at the mouth of Vaippar river.

Off-lying islets and shoals.—Musal tivu, 8 miles south-westward of Thonithorai, and the islands, islets, and dangers eastward of Musal tivu, are described on pages 126-127.

Muli tivu is situated about 5½ miles westward of Musal tivu, Valai tivu, about 1¼ miles westward of Muli tivu, Talairi tivu, about half a mile westward of Valai tivu, Appa tivu, about 3¾ miles westward of Talairi tivu, Puvarasanhalli tivu, about 3½ miles westward of the south-western end of Appa tivu, Balayamunai tivu, about three-quarters of a mile west-south-westward of Puvarasanhalli tivu, and Anaipar tivu, about 2 miles westward of Balayamunai tivu; these low-lying islands and islets should be given a wide berth, and large vessels should not sight any of them, with the exception of Anaipar tivu and Manauli island, nor get into depths of less than 12 fathoms (21m9).

The depths outside this chain of islets and shoals are tolerably regular, with overfalls in places, with the exception of a 2½ fathom (4m6) shoal which lies about 4 miles south-south-eastward of Muli tivu.

Nalla Tanni tivu, an island about 5 miles west-south-westward of Valinokkam point and about one mile offshore, and Shuli tivu, an islet about 1¾ miles westward of Nalla Tanni tivu, lie on the same shallow flat.

A shoal patch, with a least depth of 2¾ fathoms (5m0), lies about three-quarters of a mile south-south-westward of Shuli tivu.

Uppu Tanni tivu, an islet about 2¾ miles west-south-westward of Shuli tivu, lies about 2½ miles offshore.

Caution.—Vessels, other than small coasting vessels, should not approach the coast between Valinokkam point and Tuticorin, about 37 miles south-westward, to within a distance of from 6 to 7 miles, on account of the many off-lying shoals.

Pilots.—Pilots for Kilakkarai passage and Pamban pass are stationed at Kilakkarai (*Lat. 9° 14′ N., Long. 78° 47′ E.*).

Charts 828, 827, 70, 748b.

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Chart 68a.

Anchorages.—There is anchorage for small vessels with local knowledge south-eastward of Muttupettai Betel (page 131) in depths of from $2\frac{3}{4}$ to 5 fathoms (5^m0 to 9^m1); this anchorage is somewhat sheltered from the south-west monsoon.

Anchorage can be obtained by small vessels with local knowledge off the town of Kilakkarai, the best berth being with a detached ruin eastward of the town bearing 000° and some large terraced houses about 315°, in a depth of $2\frac{3}{4}$ fathoms (5^m0), stiff mud.

Kilakkarai passage.—Directions.—Kilakkarai passage can only be used by small vessels with local knowledge, there being many shoals with a depth of 6 feet (1^m8), and the channels between them being narrow and undefined; it affords a smooth passage for small coasting vessels for half the distance between Pamban and Tuticorin.

The route leads between Valinokkam point and Anaipar tivu, and thence southward of the sunken rock, marked by a beacon, half a mile south-south-eastward of the salient point $4\frac{1}{2}$ miles south-westward of Kilakkarai, to the anchorage off Kilakkarai.

From Kilakkarai an east-north-easterly course should be steered until the western end of Talairi tivu bears 126°, when it should be steered for on that bearing with the two white leading beacons in line astern; this leads over a flat in a depth of $2\frac{1}{4}$ fathoms (4^m1).

After the depth has increased to 4 fathoms (7^m3), and when the two ruined bungalows, $5\frac{1}{2}$ miles eastward of the leading beacons, bear about 045°, an east-north-easterly course should be steered until the bungalows bear 315°. Thence the course is easterly to the western entrance of Puma channel, in the approach to which the shoals northward of Musal tivu must be avoided.

Chart 3581.

The directions for proceeding through Puma East channel are given on page 130.

Chart 68a.

WESTERN SIDE OF GULF.—Coast.—Dangers.—Between the entrance to Vaippar river and Tuticorin (*Lat. 8° 48′ N., Long. 78° 09′ E.*), about 13 miles south-south-westward, the coastline forms a bight, at the head of which, and about 7 miles south-westward of Vaippar, is the town of Pattanamarudur, where are some large trees which are visible from a distance of from 9 to 10 miles offshore.

This bight is occupied by a flat, with depths of less than 3 fathoms (5^m5), which extends to a distance of about $4\frac{1}{2}$ miles offshore; on this flat lie Kariya Shuli and Vilangu Shuli, three low-lying sandy islets, about $3\frac{1}{2}$ miles south-south-westward of the western entrance point of Vaippar river.

Caution.—*See* page 132.

Chart 67.

Tuticorin.—Tuticorin is the principal outlet of the districts of Ramanathapuram, Madurai and Tirunelveli. The roadstead is quite open, but is available in all seasons as the south-west monsoon blows over the land, and the sea remains smooth.

The land about Tuticorin is low and sandy, with palmyra trees near the town. The following objects are prominent and can be easily identified:—The yellow spire of Sacred Heart cathedral, 166 feet (50^m6) high, about 3 cables north-westward of the light on the pier-

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Chart 67.

head; the grey spire of the Roman Catholic church, 110 feet (33m5) high, about 2½ cables south-westward of the same light; and a statue about half a mile north-eastward of the cathedral.

On nearer approach the various churches and the port office flagstaff near the Roman Catholic church will be readily discerned.

There is also a remarkable red mountain, 1,028 feet (313m3) high, named Valanad, about 17 miles west-south-westward of Tuticorin (*Lat. 8° 48′ N., Long. 78° 09′ E.*), which may be seen before Pandyan Tivu lighthouse is visible.

Lights.—Signal station.—Storm signals.—A light is exhibited, at an elevation of 88 feet (26m8), from a black masonry tower with white bands, 76 feet (23m3) in height, situated on the northern end of Pandyan tivu, about 2½ miles east-south-eastward of Tuticorin. *See* view [2]. The lighthouse is connected with the general telephone system.

A signal station with a flagstaff, 95 feet (29m0) high, is situated about one cable northward of the lighthouse. Communication is by means of the International Code of Signals.

Storm signals are displayed from the signal station; the general system is used. *See* page 20.

A light is exhibited, at an elevation of 38 feet (11m6), from a white masonry obelisk, 33 feet (10m1) in height, about 2½ cables within the southern end of Punnaiyadi tivu and about 2¼ miles south-south-westward of Pandyan Tivu lighthouse.

Leading lights are exhibited at Tuticorin; the front light, at an elevation of 29 feet (8m8), from the head of the landing pier; the rear light, at an elevation of 44 feet (13m4), from an iron framework structure about 1½ cables westward of the front light. These lights, in line bearing 277½°, lead through the boat channel (page 135) to the piers at Tuticorin.

Islands and dangers.—Beacons.—Buoyage.—The coastal bank, with depths of less than 18 feet (5m5), extends about 3¾ miles eastward from the town and from about three-quarters of a mile to one mile eastward from Pandyan tivu and Punnaiyadi tivu. The islets, reefs and rocks, described below, lie on this bank.

Karsewar tivu, lying about 5 miles north-north-eastward of Pandyan Tivu lighthouse and 3¾ miles offshore, is fringed by a reef.

Van tivu, situated about 1¾ miles south-westward of Karsewar tivu, stands on a reef, which extends about 3 cables north-eastward, 3½ cables eastward and 4 cables south-eastward from it. A grey obelisk, 31 feet (9m4) in height, stands on the southern side of the islet.

Sevandapar, a rock with a depth of 3 feet (0m9) over it, lies about 9½ cables south-westward of Van Tivu obelisk; it is marked by a red conical buoy moored close eastward of it.

Seltive reef (*Lat. 8° 49′ N., Long. 78° 12′ E.*), which dries one foot (0m3), lies about 1¾ miles south-westward of Van Tivu obelisk on a narrow bank, with depths of less than 6 feet (1m8), which extends north-westward from a position 2½ cables south-eastward of Seltive reef to the shore. A rocky shoal, with depths of 5 feet (1m5), lies about 3 cables north-eastward of the reef.

Kariapar, a rocky pinnacle with a depth of 5 feet (1m5) over it, lies about 9¼ cables north-eastward of Pandyan Tivu lighthouse. Two rocky pinnacles, each with a depth of 5 feet (1m5) over it, lie

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Chart 67.

2 cables eastward and 5¼ cables east-north-eastward, respectively, of Kariapar.

A rocky shoal, with a depth of 6 feet (1m8) over it, lies about 8 cables north-eastward of Kariapar.

Orripar, a rocky shoal with a least depth of 3 feet (0m9), lies about 4 cables northward of Pandyan Tivu lighthouse.

Pandyan tivu and Punnaiyadi tivu were formerly two separate islands; they are now joined together and the southern end of Punnaiyadi tivu is joined to the mainland westward; they stand on a reef, which dries and extends up to 4½ cables eastward and southward from them.

A beacon stands about 6 cables westward of Pandyan Tivu lighthouse.

Muramshulli reef, which dries, lies about 8 cables southward of Punnaiyadi Tivu lighthouse.

Anchorage.—The anchorage in the roadstead is with Pandyan Tivu lighthouse bearing between 260° and 292°, distant from 2 to 2½ miles, in depths of from 27 to 33 feet (8m2 to 10m1); the holding ground is good, mainly sand, mud and shingle.

In the north-east monsoon vessels should have a good scope of cable and a second anchor always ready, as the sea breeze blows on to the reef eastward of Pandyan tivu.

In the south-west monsoon, from about the middle of May to the middle of August, the wind, though violent, is invariably offshore, west to south-west, and the water is fairly smooth.

Channel.—Buoyage.—Beacon.—A boat channel, about 450 feet (137m2) wide, leads to the piers at Tuticorin from a position about 1¼ miles north-eastward of Pandyan Tivu lighthouse (*Lat. 8° 47′ N., Long. 78° 11′ E.*). In 1955, there was a least depth of 7 feet (2m1) in the channel, and dredging was in progress.

The channel is buoyed with light-buoys and buoys westward of a position 6 cables northward of Pandyan Tivu lighthouse as indicated on the chart.

The leading lights at Tuticorin, in line bearing 277½°, lead through the channel.

A beacon stands about 4 cables south-eastward of Tuticorin front leading light.

Piers.—There are five piers with lengths varying from 138 to 478 feet (42m1 to 145m7) and with an average depth of 11 feet (3m3) alongside. A number of cranes, with capacities of from one to five tons, are situated on or in the vicinity of the piers; all the cranes are worked by hand.

Currents.—Tidal streams.—The currents along the coast, outside the islands near Tuticorin, generally set with the wind, varying in strength from one to 2 knots. At the change of the monsoons they are weaker and variable. It has been noticed that when there is a lull in the monsoon there is a tendency for the current to set into, instead of across, the Gulf of Mannar.

The tidal streams at Tuticorin set in a northerly direction with the flood tide, and in a southerly direction with the ebb.

Directions.—Vessels approaching Tuticorin, before steering for the anchorage, should make sure of their position, as the coast is low, and shoals extend some distance from it. Vessels making the anchorage at night should steer a safe course outside the off-lying dangers,

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Chart 67.

and anchor with Pandyan Tivu light bearing between 260° and 292°, in depths of from 27 to 33 feet (8m2 to 10m1).

Town.—The town of Tuticorin (*Lat. 8° 48′ N., Long. 78° 09′ E.*) is the largest commercial town on the western side of the Gulf of Mannar; in 1951, it had a population of 98,866.

The landing pier is the one with Tuticorin front leading light on its head.

Port facilities.—Fresh provisions are plentiful. Drinking water, which should be boiled, is supplied in casks but is available only in very small quantities.

A considerable stock of coal is maintained.

There are two tugs and a number of lighters available.

Small repairs can be executed.

There is a small government hospital to which seamen are admitted.

Communications.—There is regular sea communication with Calcutta, Madras, Colombo, Bombay and Karāchi.

Tuticorin is connected with the general railway and telegraph systems.

Radio.—There is a radio station at Tuticorin. *See* page 24.

Trade.—Shipping.—The principal exports are cotton, grains and cement and the imports general merchandise.

In 1954-55, 459 vessels, with an aggregate tonnage of 661,080, entered the port.

Charts 68a, 68b.

Coast.—Dangers.—Between Punnaiyadi tivu and Manappad point, about 24 miles south-south-westward, the coast is, generally speaking, low and sandy and fringed with coconut trees. In clear weather the Southern Ghâts, the mountain range dividing the States of Madras and Kerala, may be visible some distance inland.

There are depths of 10 fathoms (18m3) at distances of from about 10 to 13 miles offshore, and there are pearl banks just within these depths as far southward as Kayalpattanam, about 12 miles south-south-westward of Punnaiyadi tivu.

Chart 68a.

A 5½-fathom (10m1) shoal is situated about 4 miles south-eastward of Punnaiyadi tivu.

Charts 68a, 68b.

Punnaikkayal, a small fishing village about one mile inland, is approached by a creek, the mouth of which is about 7½ miles south-south-westward of Punnaiyadi tivu (*Lat. 8° 45′ N., Long. 78° 11′ E.*); it may be identified by the ruins of a church, and a scanty clump of palmyra trees on the beach.

A 2½-fathom (4m6) shoal lies in the eastern approach to Punnaikkayal, about 7½ miles southward of Punnaiyadi tivu and about 2 miles offshore.

Chart 68b.

Between the creek leading to Punnaikkayal and Tiruchendur point, about 8 miles southward, the coastal reef, on which the sea breaks in depths of from 2½ to 3 fathoms (4m6 to 5m5) in heavy weather, extends to a distance of about 2½ miles offshore; in ordinary weather the sea breaks farther inshore in depths of 2 fathoms (3m7) or less.

Kayalpattanam is a small port, situated about 4 miles northward of Tiruchendur point, at which coasting vessels call occasionally. On the

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Chart 68b.

sandy coast there are some coconut trees, and there are some hills a short distance inland.

Virapandiyanpattanam, near the coast, about 2½ miles southward of Kayalpattanam, is a small town inhabited by fishermen.

Tiruchendur point is a low, rocky, bluff headland with a remarkable dark-coloured high pagoda on its extremity, which can be seen from a distance of about 15 miles, and is a useful landmark.

Tiruchendur, about a quarter of a mile south-westward of the pagoda, is a small town; it is connected with the general railway system.

A 4½-fathom (8m2) rocky shoal is situated about 2¾ miles east-south-eastward of Tiruchendur point (*Lat. 8° 30′ N., Long. 78° 08′ E.*).

A bank, with a depth of 9½ fathoms (17m4), was reported, in 1928, by the s.s. *Winkfield*, to lie about 12 miles east-south-eastward of the same point.

Alantalai is a village on the coast, about 1¾ miles south-westward of Tiruchendur; foul ground extends to a distance of about three-quarters of a mile offshore between these places.

Alantalai shoals, lying about 4 miles east-south-eastward of Alantalai, consists of two patches, the north-eastern of which has a depth of 3½ fathoms (6m4), and the south-western a least depth of 2 fathoms (3m7).

Between Alantalai and Manappad point, situated about 5½ miles south-south-westward, there is an area of foul rocky ground, which extends to a distance of 2¾ miles offshore, and over which there are heavy breakers during the north-east monsoon; these breakers extend to a distance of about one mile south-eastward from Manappad point.

Kulasekarapatnam, about 4¾ miles south-south-westward of Alantalai, is a town and a small port, which may be identified by the ruins of a large church, half buried in the sand, and by the mouth of a stream. Coastal steamers call here occasionally; it is connected with the general railway system.

A port pillar, 25 feet (7m6) high and painted white with a black band in the centre, has been erected abreast the town.

Manappad point is a high sandy promontory, based on rock, jutting boldly into the sea and having a lighthouse and a church on its summit. The village of Manappad is three-quarters of a mile westward of the lighthouse.

Light.—A light is exhibited at an elevation of 134 feet (40m8) from a cement tower, 62 feet (18m9) in height, situated on Manappad point.

Charts 68a, 68b.

Anchorages.—Anchorage can be obtained by small vessels with local knowledge off Punnaikkayal, about 1½ miles offshore, with a clump of trees bearing 258°, in a depth of 4 fathoms (7m3); this anchorage is sheltered from southerly winds by the coastal reef southward.

Chart 68b.

Small vessels with local knowledge can obtain anchorage off Virapandiyanpattanam in depths of from 1½ to 2 fathoms (2m7 to 3m7); this anchorage is somewhat protected from the southward by the coastal reef extending north-eastward from Tiruchendur point. The centre of the town bearing 241° leads in from the north-eastward through a gap in the coastal reef.

Vessels can obtain anchorage with Alantalai church (*Lat. 8° 28′ N.*,

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Chart 68b.

Long. 78° 06′ E.) bearing 292°, distant 1¾ miles, in a depth of 4 fathoms (7m3), mud; this anchorage is protected from south-westerly winds by the coastal reef southward.

Coast.—Dangers.—From Manappad point the coast trends in a west-south-westerly direction for about 20 miles to East cape, and between this cape and Cape Comorin, about 15½ miles west-south-westward, the coastline forms a bight. This part of the coast is somewhat higher than the remainder of the coast on the western side of the Gulf of Mannar, with undulating sandhills, attaining elevations of from 100 to 200 feet (30m5 to 61m0); the background is mostly of a reddish soil, covered with palmyra trees and bushes, and rises gradually to the foot of the Southern Ghâts, which at Cape Comorin are about 3 miles inland. There are numerous villages and small whitewashed churches along the coast, but landing in a ship's boat is at all times a difficult and dangerous operation.

A shoal, with a depth of 4½ fathoms (8m2), lies about 5 miles south-eastward, and Manappad Outer shoal, with a least depth of 4 fathoms (7m3), about 8 miles south-eastward of Manappad point; a 5½-fathom (10m1) patch was reported, in 1958, about 20 miles east-south-eastward of Manappad point; a shoal, with a least depth of 5½ fathoms (10m1), is situated about 6 miles south-south-eastward of the same point. A vessel should avoid passing over this area; in thick weather a wide berth should be given to it, and a vessel should not get into depths of less than 20 fathoms.

Periya Talai, a small town on the coast, is situated about 6½ miles west-south-westward of Manappad point.

East cape (*Lat. 8° 12′ N., Long. 77° 47′ E.*) is prominent; the coastal reef in this vicinity, with depths of 3 fathoms (5m5) at its edge, extends to a distance of about one mile offshore.

Chart 751.

Cape Comorin, the southern extremity of India, is a low sandy cape, with a small white pagoda on its point; the pagoda is surrounded by a high wall that leaves only the top of it visible; north-westward of the pagoda is the bungalow formerly occupied by the British Resident. For radar range *see* Appendix III on page 346.

The village of Kanniyakumari, standing amongst coconut trees with high reddish ground at its back, lies half a mile northward, and Vattakottai fort about 3½ miles north-north-eastward, of the cape. Close westward of the pagoda the coast is sandy and barren; close north-eastward it abounds with trees.

A masonry obelisk, 25 feet (7m6) in height, has been erected on the coast, about 1¾ miles northward of the cape, to indicate the position of a wreck which lies half a mile east-south-eastward of the obelisk.

Northward of Cape Comorin the land rises in a gradual slope, so that when seen from a distance it has the appearance of being a high sandy promontory. The nearest mountain is about 4¼ miles north-westward of the cape; it attains an elevation of 1,213 feet (369m7), and has the appearance of a pointed cone, except when seen from the eastward or southward. About 9 miles further northward is a range attaining an elevation of 3,416 feet (1,041m2), which resembles a camel's hump, and at a distance of about 15 miles is Mahendragiri; these high peaks of the Southern Ghâts have been mistaken, by vessels at a great distance, for the 1,213-foot (369m7) mountain described above.

Charts 828, 827, 70, 748b.

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Chart 751.

Three rocks, on which the sea breaks, lie close south-eastward of Cape Comorin (*Lat. 8° 05′ N., Long. 77° 33′ E.*); foul ground extends about half a mile south-eastward and southward from the cape.

Caution.—When approaching Cape Comorin from north-westward in the north-east monsoon, a vessel that has been sheltered by the coast as far southward as Muttum point, about 14 miles westward of Cape Comorin, may suddenly pass from a calm into a strong breeze, even at a distance of 4 miles offshore.

Chart 68b.

Light.—A fishing light is exhibited at an elevation of 14 feet (4^{m}3) from a masonry column, 16 feet (4^{m}9) in height, situated at Kuttapuli, about 10½ miles west-south-westward of East cape.

Chart 751.

Tidal streams.—The tidal streams off Cape Comorin set in an easterly direction during the flood tide, and in a westerly direction during the ebb, but the direction and strength of the streams are much affected by the ocean currents.

Chart 68b.

Anchorages.—During the north-east monsoon good anchorage may be obtained between Manappad point and the town of Periya Talai, about one mile offshore, in a depth of 6 fathoms (11^{m}0), mud. From June to August, inclusive, when the south-west monsoon is strong, a heavy sea rolls in upon this part of the coast, and vessels then should anchor off Alantalai or Punnaikkayal.

Small vessels can obtain anchorage in the bight northward of East cape, in a depth of 4 fathoms (7^{m}3). This anchorage is somewhat protected from westerly winds and their accompanying swell by the coastal reef to the south-westward.

In the bight between East cape and Cape Comorin (*Lat. 8° 05′ N., Long. 77° 33′ E.*) vessels find shelter from westerly winds, but the swell caused by the south-west monsoon rolls round into it, and in that season no attempt should be made to land in a ship's boat.

Charts 828, 827, 70, 748b.

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CHAPTER IV

MALABAR COAST.—CAPE COMORIN TO MOUNT DELLY

Chart 751.

COAST.—Dangers.—From Cape Comorin (*Lat. 8° 05′ N., Long. 77° 33′ E.*) the Malabar coast (page 6) trends west-north-westward for about 14 miles to Muttum point, on which there is a lighthouse. *See* view **[3]**.

A heavy surf prevails all along the coast between Cape Comorin and Muttum point, and only catamarans are used by the natives; no ship's boats should attempt a landing.

Manakkudi is a village on the coast, about 4 miles westward of Cape Comorin, having on its eastern side a lake which flows into the sea during the rains; during the dry season the entrance to the lake is closed.

Muttum point, on which is the village of Muttamtura, is about 114 feet (34^{m}7) high, with steep red cliffs. A grove of palmyra palms is situated at an elevation of 280 feet (85^{m}3) on high red ground, about one mile northward of the lighthouse. This grove forms an excellent landmark, which can usually be seen above the mist when the lighthouse is obscured. For radar range *see* Appendix III on page 346.

A sunken rock, on which the sea breaks, lies about 3 cables south-south-westward of the lighthouse; another rock, which dries one foot (0^{m}3), is situated about 1½ cables offshore, half a mile west-north-westward of the lighthouse.

Foul ground, with a least depth of 9 feet (2^{m}7) over it, is situated about 3 miles north-westward of the lighthouse and about half a mile offshore.

From Muttum point the coast extends north-eastward for about 5½ miles to Kolachel.

Off-lying islets and dangers.—Crocodile rock, situated about 3 miles south-westward of the lighthouse, has a depth of less than 6 feet (1^{m}8) over it; in calm weather the sea does not always break over it. A vessel in this vicinity at night should not approach into depths of less than 25 fathoms (45^{m}7). Breakers were reported, in 1946, in a position over half a mile south-south-eastward of Crocodile rock.

Adunda, an islet 8 feet (2^{m}4) high, lying about 1¼ miles south-westward of the lighthouse, is difficult to identify from seaward; foul ground extends about 1½ cables north-north-westward from it.

Kota, an islet 12 feet (3^{m}7) high, lying about 1¼ miles west-north-westward of Adunda, is steep-to on its western side, but foul ground and shoal water extend about 1½ cables northward and 3½ cables eastward and southward from it.

Caution.—A vessel should not pass inshore of Adunda and Kota.

Charts 827, 828, 70, 748b.

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Chart 751.

Light.—A light is exhibited, at an elevation of 141 feet (43m0), from a column, painted with black and white horizontal bands, 72 feet (21m9) in height, situated on Muttum point. *See* view [3].

Chart 68b.

Outlying bank.—Wadge bank, situated about 25 miles south-westward of Cape Comorin, has a least depth of 30 fathoms (54m9).

Chart 751, plan of Kolachel anchorage.

Kolachel.—Kolachel is a port of some importance. There is regular communication by sea with the other ports on the Malabar coast, also with Colombo and Bombay. There is occasional communication by sea with Karāchi.

Chart 751.

Landmarks.—The best landmarks for making Kolachel are Aunipauri hills, about 4½ miles northward of Kolachel, which consist of two summits, 686 and 643 feet (209m1 and 195m6) high, respectively.

Chart 751, plan of Kolachel anchorage.

On nearer approach the following objects are prominent and can be easily identified:—The flagstaff close to Kolachel light-structure; the Roman Catholic church, about a quarter of a cable north-north-westward of Kolachel light-structure; a low godown, about 2½ cables eastward of the same light-structure; a small house with a tiled roof, about one cable east-south-eastward of the godown, with a white cross close south-eastward of it; and a white masonry pillar with black bands, 17 feet (5m2) high (from which a light is periodically exhibited, *see* below), close east-south-eastward of the white cross.

Lights.—Kolachel light is exhibited, at an elevation of 40 feet (12m2), from a white platform, situated on a mound close to the flagstaff at Kolachel.

A light is periodically exhibited, at an elevation of 25 feet (7m6), from a wooden platform on a white masonry pillar with black bands, 17 feet (5m2) in height, situated about 3½ cables eastward of Kolachel light-structure (*Lat. 8° 10′ N., Long. 77° 15′ E.*).

Dangers.—Pul un ni, 6 feet (1m8) high, situated about 3¾ cables south-south-eastward of Kolachel lighthouse and about 3 cables offshore, is the south-easternmost of the dangers in the approach to Kolachel.

Patna rock, lying about one cable west-north-westward of Pul un ni, has a depth of 7 feet (2m1) over it.

Constance rock, about 2 cables north-westward of Pul un ni, has a least depth of 7 feet (2m1) over it.

Several rocks, above and below water, extend from about 1¾ cables southward to 3 cables south-westward from Kolachel light-structure; of these the principal ones are:—Kur sai kul, 12 feet (3m7) high and situated about one cable southward of Kolachel light-structure, is surmounted by a small white shrine carrying a patriarchal cross which adds about 4 feet (1m2) to the height of the rock; Ahna kul, the southernmost of a group of three rocks lying close together, is situated close south-south-eastward of Kur sai kul, with a rock awash close to its south-eastern extremity; Sud de kul, situated about 1½ cables south-westward of Kur sai kul, with an above-water rock about a quarter of a cable north-westward of it; and Cha de kul, which lies about 1¼ cables northward of Sud de kul and nearly the same distance west-north-westward of Kur sai kul.

Charts 827, 70, 748b.

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Chart 751.

Anchorages.—Small vessels can obtain anchorage with the summit of Aunipauri hills bearing 013°, and the lighthouse on Muttum point (*Lat. 8° 07′ N., Long. 77° 19′ E.*) bearing 115°, in depths of from 11 to 12 fathoms (20m1 to 21m9).

Small vessels can also obtain anchorage with the flagstaff at Kolachel bearing 326°, distant 6 cables, in depths of from 7 to 8 fathoms (12m8 to 14m6), sand.

There is a heavy surf on the coast, but the rocks off-lying the village form a partial breakwater, within which landing is comparatively easy during the fine season.

Storm warnings.—Storm warnings are received at Kolachel but no signals are hoisted. *See* page 23.

Coast.—Dangers.—From Kolachel the coast trends in a general north-westerly direction for about 26 miles to Trivandrum; it is sandy, fringed with coconut trees, and, except in the vicinity of Enciam islet, about 4½ miles north-westward of Kolachel light-structure, is safe to approach. A little eastward of Enciam islet the steep coast has a reddish appearance. There are small white churches in almost every village along this part of the coast.

Enciam islet, lying about a quarter of a mile offshore, has a church on it; Enciam rocks, above and below water, extend about a quarter of a mile south-westward and half a mile north-westward from Enciam islet; a vessel should be careful not to approach into depths of less than 20 fathoms (36m6) when in the vicinity of this islet at night, as these depths are only about 2¼ miles from Enciam rocks.

Pūvār village is situated on the coast, about 9 miles north-westward of Enciam islet; about 3 miles north-westward of this village is the village and backwater of Karichal.

About 4¼ miles north-westward of Karichal the coast is low and level, terminating in Kovalam point, a bluff point with a conspicuous building with a red roof on it; between this point and Trivandrum it is hilly and undulating inland.

Off-lying shoals.—Shoals, with depths of 8 and 9 fathoms (14m6 and 16m5), lie 3½ and 4½ miles, respectively, north-westward of Kovalam point. In 1940, the former shoal was reported to be extending north-westward.

Trivandrum.—Trivandrum (*Lat. 8° 29′ N., Long. 76° 57′ E.*) is the capital of the State of Kerala and a city of considerable extent; it is situated about one mile from the coast. The population, in 1951, was 186,931.

Storm warnings.—Storm warnings are received at Trivandrum but no signals are hoisted. *See* page 23.

Charts 751, 827, 828.

Aspect.—Landmarks.—Inland of Trivandrum are part of the Western Ghâts, (page 6). Agastya Malai (Cuchy Mulla), about 19 miles east-north-eastward of Trivandrum, 6,125 feet (1,866m9) high, being the highest peak.

Between this range and the coast there are lower hills, one of which, Naimum hill, 828 feet (252m4) high, about 3¾ miles east-south-eastward of the town, has a round summit, sloping gradually, and is visible at a considerable distance from the southward; it can also be seen from Anjengo roadstead, about 15 miles north-westward of Trivandrum.

Charts 827, 70, 748b.

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Chart 751.

The coast in the vicinity of Trivandrum is sandy, with coconut and other palms on it. The ruins of the pier, on which there was formerly a light, extend as far as the low-water line 5 miles north-westward of Kovalam point; they are a prominent mark. Among the several buildings on the coast southward and south-westward of the town, Pondera church, situated about half a mile south-eastward of the ruined pier, can be easily identified. For radar range *see* Appendix III on page 346.

Trivandrum observatory, with two white domes, 196 feet (60^{m}7) high, stands on a hill 2 miles northward of the town. The fort stands on ground 100 feet (30^{m}5) high, and within its precincts is one of the Maharajah's palaces. Another of the Maharajah's palaces, a white rectangular building with a dull red roof, stands on the coast about 1¼ miles north-westward of the ruined pier.

A flagstaff, 95 feet (29^{m}0) high, stands immediately south-eastward of the pier ruins.

Anchorage.—Vessels can obtain anchorage with the above flagstaff bearing 077°, distant about 3¾ cables, in a depth of 10 fathoms (18^{m}3).

Landing should not be attempted in ship's boats, because there is generally a surf during the north-east monsoon.

Communications.—Trivandrum is connected with the railway system.

Canals within the coast connect Trivandrum to the great backwater system of Kerala.

There is regular communication by sea with other ports on the Malabar coast, also with Colombo and Bombay.

Climatic table.—*See* page 47.

Charts 750, 751.

Coast.—From Trivandrum the coast trends north-westward for about 15 miles to Anjengo. It is sandy, fringed with coconut trees, and safe to approach. There are small white churches in almost every village on this coast. Inland the country is hilly and undulating.

There is a red tableland about 4 miles northward of Anjengo (*Lat. 8° 40′ N., Long. 76° 46′ E.*), which may assist in identifying that place. This, and similar tablelands along the coast, being higher than the coconut trees, appear like red cliffs on the coast, when seen from a greater distance than 7 miles.

Anjengo was formerly an important place, but is now only a fishing village.

The port is seldom visited, and the anchorage is unsheltered, with a heavy surf even when the weather is fine. As Anjengo fort and the few houses that are visible through the surrounding trees are low, this place is not easily identified from even a short distance. A church with a white front will be seen on the coast north-westward of the fort, and a bungalow on the hills 2 miles northward of it.

Between Anjengo and Tangasseri point, about 18 miles farther north-westward, the aspect of the coast is similar. About 6 miles south-eastward of Tangasseri point, there is a gap in the coconut trees fringing the coast, where there is an extensive backwater.

Chart 751.

Anchorage.—Anchorage may be obtained abreast Anjengo, about one mile offshore, in depths of from 11 to 12 fathoms (20^{m}1 to 21^{m}9), sand and shells. The bottom is foul and rocky in depths of less than

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Charts 751.

10 fathoms (18m3). Agastya Malai (page 142) can be seen from this anchorage.

Chart 750, with plan of Quilon road.

Quilon road.—Quilon road is the name given to the bight close south-eastward of Tangasseri point (*Lat. 8° 53′ N., Long. 76° 34′ E.*). The coast is steep and sandy as far north-westward as Tangasseri cove, about 2¾ cables north-eastward of Tangasseri point; the coast here is rocky, and it continues rocky to Tangasseri point, and for about 3 miles north-north-westward of it. Coconut groves grow close to the high-water line. For radar range *see* Appendix III on page 346.

The following objects are prominent:—The lighthouse on Tangasseri point; the red chimney of the tile works situated about 1¼ miles eastward of the lighthouse; and the south-eastern boundary pillar, which lies about 3 miles east-south-eastward of the lighthouse.

Chart 750, plan of Quilon road.

There is a heavy surf and landing is dangerous, except in native boats.

The port is in charge of a Conservator; it is closed during the south-west monsoon, from the 15th May to the 14th September, inclusive.

Lights.—A light is exhibited, at an elevation of 135 feet (41m1), from a concrete tower, 135 feet (41m1) in height, situated on Tangasseri point.

A light is periodically exhibited, at an elevation of 40 feet (12m2), from a wooden platform on iron posts, situated on the beach near the port flagstaff, about 1¼ miles eastward of the lighthouse on Tangasseri point.

Chart 750, with plan of Quilon road.

Port limits.—The southern and northern limits of the port are defined by lines drawn in a 247° direction from the two boundary pillars, the south-eastern of which is situated about 3 miles east-south-eastward of Tangasseri Point lighthouse, and the north-western about 6½ cables east-north-eastward of the same lighthouse; the western limit of the port is defined by a line drawn in a 180° direction from Tangasseri Point lighthouse (*Lat. 8° 53′ N., Long. 76° 34′ E.*).

Dangers.—Buoys.—The coastal reef extends about 8½ cables southward from Tangasseri point; the south-eastern part, which is known as Pallikall shoal dries, and the remainder has general depths of less than 3 fathoms (5m5). In a westerly swell the sea breaks heavily on this reef, which, in 1936, was reported to be extending southward.

Tangasseri reef consists of foul ground and shoal water extending about one mile south-westward and 1½ miles westward from Tangasseri point; the sea breaks over this reef.

A red conical buoy is moored about 1¼ miles south-eastward of Tangasseri point. It marks the north-western extremity of a number of detached rocky shoals, extending about one mile farther south-eastward, with a least depth of 3½ fathoms (6m4) over them.

A black conical buoy is moored close north-westward of a 4½-fathom (8m2) shoal, situated about one mile south-eastward of Tangasseri point.

The entrance channel to Quilon road lies between these two buoys.

A conical buoy, painted black and white in vertical stripes, is moored close north-westward of Gamaria rock, which has a depth of 4¼ fathoms (7m8) over it, and lies about 1¼ miles south-eastward of Tangasseri point.

Charts 827, 70, 748b.

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Chart 750, plan of Quilon road.

Anchorages.—The anchorage off Quilon is open to all winds from north-west, through west, to south-east, and is little frequented during he south-west monsoon, when only communication by signal is practicable with the shore. Vessels at this season should anchor with Tangasseri point bearing about 360°, distant rather over one mile, in depths of not less than 8 fathoms (14m6).

Between October and May vessels can anchor in the inner anchorage, between Gamaria rock and Pallikall shoal, with the red chimney of the tile works bearing 040°, and Tangasseri Point lighthouse bearing 299°, in a depth of 4¾ fathoms (8m7), sand. A position about 2½ cables south-westward of this anchorage may be found to be more comfortable for a large vessel.

Signals for vessels at anchor are made from the flagstaff near the tile works.

Chart 750, with plan of Quilon road.

Directions.—A vessel approaching Quilon from the northward should not proceed into depths of less than 13 fathoms (23m8) when nearing Tangasseri point, in order to avoid the foul ground extending westward from it.

When the south-eastern boundary pillar bears 095° a vessel will be southward of the dangers extending westward and southward from Tangasseri point; the pillar should be steered for on that bearing until the light-structure on the foreshore is in line with the tile works' conspicuous red chimney, bearing 044°; course should then be altered to keep them in line on that bearing, which leads between the two channel buoys; care must be taken to avoid the 4½-fathom (8m2) shoal close north-westward of the leading line, eastward of the black buoy.

Should the light-structure be obscured by smoke or haze, the port flagstaff, slightly open northward of the conspicuous red chimney, and bearing less than 044°, provides an alternative leading line for the channel.

Chart 750, plan of Quilon road.

Quilon.—Quilon (*Lat. 8° 53′ N., Long. 76° 35′ E.*), situated near the coast, is one of the larger towns of the State of Kerala and the head-quarters of Quilon district; in 1951, it had a population of 66,126. There are many public buildings near the town; the port office and custom house are on the coast. The Anglican church is eastward of the town, while along the banks of the coast canal are several bungalows.

Tangasseri settlement is situated on Tangasseri point. There is an old British and Dutch cemetery among the ruins of the old fortifications.

Communications.—Quilon has continuous water communication by backwater and canal with Trivandrum southward, and northward to Alleppey and Cochin, thence to Shoranur.

There is regular communication by sea with Colombo and Bombay, also with other ports on the Malabar coast.

Quilon is connected with the railway system.

Port facilities.—Limited supplies of provisions can be obtained. Coal and fuel oil can be procured in small quantities. Fresh water can be obtained.

Small repairs to engines and boilers can be carried out.

There is a Government hospital to which seamen are admitted.

A number of boats for transfer of cargo are available.

Charts 827, 70, 748b.

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Chart 750, plan of Quilon road.

Storm warnings.—Storm warnings are received at Quilon but no signals are hoisted. *See* page 23.

Trade.—Shipping.—The chief industry is the manufacture of tiles. The principal exports are coconut oil, coir mats, timber and fish; the principal imports are paddy, rice, tobacco, salt and tea.

Chart 750.

Coast.—Dangers.—Lights.—Signal station.—From Tangasseri point to a boundary pillar situated about 5¾ miles north-north-westward, which has a flagstaff close south-westward of it, foul ground extends from 1½ to 2 miles offshore. A vessel approaching this part of the coast at night should be careful not to proceed into depths of less than 15 fathoms (27m4).

An obstruction was reported, by the s.s. *Pasha*, in 1935, to lie about 4¼ miles west-north-westward of Tangasseri lighthouse and about 2 miles offshore.

Nindakara Azhi, about 3¾ miles north-north-westward of Tangasseri point, is the outlet of Ashtamudi kāyal, and can be identified from seaward by a break in the coconut trees and a conspicuous bridge which traverses the outlet. The entrance is very shallow, and foul ground extends about 2 miles offshore; the bar is about 2 cables wide, and has a least depth of 4 feet (1m2), sand. Inside the bar there is a narrow channel which leads into the backwater, and thence connects with the inland canals. Kallada ār flows into the north-eastern corner of Ashtamudi kāyal.

There is a conspicuous casuarina tree, adjoining a church, situated close southward of Nindakara Azhi. A flagstaff stands at Koilthottam, where there is a mill, about 2¾ miles northward of the bridge.

A light is exhibited, from a white wooden framework structure, with red horizontal bands, 20 feet (6m1) in height, situated about a quarter of a mile northward of the mill at Koilthottam.

There is a signal station close north-eastward of the lighthouse.

From the boundary pillar mentioned above to Pathiyankara, about 17 miles farther north-north-westward, the coast continues to be sandy and fringed with coconut trees.

A light is periodically exhibited in the vicinity of Pathiyankara; the position of this light varies in accordance with the position of the Alleppey mudbank (*see* page 147).

Trikkunnapuzha is a village on the coast about 1¼ miles north-north-westward of Pathiyankara.

Kottappalli (South Vazhapuram) is a village close to the coast, about 4½ miles north-north-westward of Trikkunnapuzha.

Pirakkād about 2 miles father northward, is a small town; the mudbank off Pirakkād (*Lat. 9° 21′ N., Long. 76° 23′ E.*) was reported, in 1934, to be extending to seaward.

In 1901, s.s. *Bhundara*, reported a shoal with a depth of 4¾ fathoms (8m7), extending for a distance of 3 miles in a north-north-westerly direction, and about 4 miles offshore, its southern end being abreast the town of Pirakkād. Depths of 8 fathoms (14m6) were obtained by the same vessel, between this end of the shoal and Pirakkād.

Anchorages.—Large vessels working cargo off Nindakara Azhi should anchor west-south-westward of the entrance in a depth of about 7 fathoms (12m8).

In fine weather vessels anchor, in a depth of about 5 fathoms (9m1),

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Chart 750.
about three-quarters of a mile off Koilhottam lighthouse, for loading ilmenite sand.

There is anchorage off Kottappalli, available for vessels with local knowledge; it is sometimes used as a port in place of Alleppey, when the latter is closed for the monsoon season, from about the middle of June to the latter part of August, or when the Alleppey mudbank is elsewhere.

Coast.—From Pirakkād to Alleppey, about 9 miles farther north-north-westward, the coast is similar in appearance, though more thickly fringed with coconut trees.

The village of Nirkunnam (Nircum) is situated about 3½ miles north-north-westward of Pirakkād, with the town of Ambalapulai situated midway between them.

There is a large isolated tree situated about 2 miles south-south-eastward of Alleppey, but it is not conspicuous.
Chart 750, plan of Alleppey road.

Alleppey road.—Alleppey (*Lat. 9° 30′ N., Long. 76° 19′ E.*) is the headquarters of Alleppey district. The southern and northern boundaries of the port are marked by a conspicuous square tower and a conspicuous pillar, respectively; the square tower, 27 feet (5m2) high, is situated on the coast about 6½ cables southward of Alleppey pier, and the pillar, 20 feet (6m1) high, stands on the coast immediately westward of another conspicuous square tower, 25 feet (7m6) high, about 2¾ cables northward of the pier.

For about 1½ miles on either side of Alleppey the coast is fringed with coconut trees from 60 to 70 feet (18m2 to 21m3) high, interspersed with native dwellings. There is an isolated and conspicuous palm tree about 1½ miles northward of the town.

The port is under the superintendence of a Principal Port Officer.

Mudbank.—Trade is carried on all the year round in this neighbourhood, owing to the peculiar softness of the mudbank off it, which is so stirred up by the swell as to break the force of the waves, and cause a large extent of smooth water, on the outer part of which vessels anchor. The mud is dark green, fine and oily to touch. The smoothness is probably caused by the oil which the mud has been found to contain. In calm weather this bank is not perceptible.
Chart 750, with plan of Alleppey road.

This mudbank shifts its position from year to year, and is sometimes as far southward as Trikkunnapuzha. In 1894 it was off Trikkunnapuzha, in 1903 off Kottappalli and in 1905 off Alleppey; in 1919 it was about 6 miles southward of Alleppey, off Nirkunnam (Nircum), and in 1926 again off Alleppey, while in 1931 it was reported to be off Pirakkād.

Northward of a position 2 miles northward of Alleppey (*Lat. 9° 3′ N., Long. 76° 19′ E.*) there is said to be a swell during the south-west monsoon, but to the southward the swell is quite deadened by this shifting mudbank.

Alleppey bank is subject to so-called mud volcanoes, which bubble up, bringing dead fish, roots and trunks of trees to the surface.

It develops toward the end of June, after the backwater is swollen by rain. It has been stated that the cause of this mudbank is the greater elevation, i.e., about 4 feet (1m2), of the water level in the vast backwater over that of the sea; thus the hydraulic pressure forces out mud

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Chart 750, with plan of Alleppey road.

and vegetable matter through the several outlets, during the south-west monsoon, forming mudbanks along the beaches and in the shallow water along the shore. Evidence, it is said, has been found of a subterraneous communication through mud between the backwater and the sea.

Chart 750, plan of Alleppey road.

Lights.—A light is exhibited, at an elevation of 108 feet (32^{m}9), from a white round masonry tower, 93 feet (28^{m}3) in height, situated about 2 cables inland, at Alleppey. When bearing between west and south-south-east the lighthouse, except the lantern, is hidden by trees. This light is unreliable.

A light is periodically exhibited from the end of the pier.

Signal station.—Storm signals.—A signal station and flagstaff stand westward of the lighthouse; the flagstaff is prominent, and from the southward it is visible before the lighthouse. Day and night communication is carried out by flashing lamp, situated on a pillar at an elevation of 53 feet (16^{m}2).

Storm signals are displayed from the signal station; the extended system is used. *See* page 20.

Anchorages.—During the north-east monsoon moderate-sized vessels can obtain anchorage off Alleppey, with the lighthouse bearing 077°, distant 2 miles, in depths of from 3 to 4 fathoms (5^{m}5 to 7^{m}3), but, as the mudbank shifts frequently, the depths given on the chart are not reliable, so that sounding is essential when approaching the port.

During the south-west monsoon the best anchorage is farther offshore with the lighthouse bearing 056°, in a depth of 4 fathoms (7^{m}3), but the anchorage depends upon the position of the mudbank, which cannot be properly determined until after the burst of the monsoon.

Current.—At the anchorage the current sets southward, sometimes at the rate of 2 knots. From October to February an occasional northerly set is experienced, but it is usually weak.

Alleppey.—Alleppey (*Lat. 9° 30′ N., Long. 76° 19′ E.*) is the third largest city in the State of Kerala, and had, in 1951, a population of 116,287. It lies between the coast and the paddy-fields bordering the backwater.

The canal connecting the port with the backwater passes through the centre of the city.

Pier.—There is one pier, 1,200 feet (365^{m}8) long with a depth of 15 feet (4^{m}6) alongside its head. Cranes with lifting capacities of up to 5 tons stand on the pier.

Communications.—There is regular communication by sea with Ceylon, and the ports on the east and west coasts of India; vessels to and from Europe, America, Australia, China and Japan also call at this port.

Supplies.—Fish and other supplies are abundant.

Trade.—The principal imports are salt, grain, metals and piece-goods. The principal exports are coir mats and matting, coir yarn and fibre, copra and ginger.

Charts 65, 749, 750.

COCHIN AND APPROACHES.—The mouth of Cochin river, about 29 miles north-north-westward of Alleppey is the principal navigable entrance to the great Kerala estuary; it provides a fine

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Charts 65, 749, 750.

natural harbour which, with its backwater, is capable of affording shelter to a large number of vessels. The port has been considerably developed and can accommodate vessels of up to 30 feet (9m1) draught.

The port is under the superintendence of the Port Administrative Officer.

Charts 750, 749, 827,

Coast.—Aspect.—Light.—Beacons.—The coast from Alleppey to Cochin (*Lat. 9° 58′ N., Long. 76° 14′ E.*) is low and sandy; southward of Cochin it is thickly fringed with palms and is densely populated.

Owing to the haze, which, even in the fine season, settles over the land after sunrise, the coast is usually indistinct until midday, and even conspicuous objects are difficult to discern.

There is no elevated land near the coast. The highest of the Western Ghâts are about 50 miles inland, but they are only distinguishable when the weather is clear. Anamalai mountains, about 30 miles north-eastward of Cochin, form a portion of the great Western Ghâts, and eventually merge into the Travancore hills.

Kollengode (Kollangod) bluff, the north-western extremity of these mountains, stands about 48 miles north-eastward of Cochin; this bluff forms the southern boundary of Pālghāt gap, through which the land winds often blow fiercely between November and February. This remarkable gap, more than 4,000 feet (1,219m2) lower than the hills on its northern and southern sides, lies between the parallels of 10° 35′ and 10° 52′ N. In the fine weather of the north-east monsoon, Kollengode bluff is very conspicuous, but after February it is seldom seen.

Charts 65, 749.

Cochin light is exhibited, at an elevation of 99 feet (30m2), from a white steel framework tower with black horizontal bands, 83 feet (25m3) in height, the lower part of which is hidden by a conspicuous white house with a red roof, situated on the southern side of the entrance to the Port of Cochin (*Lat. 9° 58′ N., Long. 76° 14′ E.*). It has been reported that during the south-west monsoon the light is frequently obscured by heavy rain.

There is a conspicuous white house, on the coast, at Kandakkadava about 6¾ miles southward of Cochin lighthouse. A water tower, 44 feet (13m4) high, and another tower, 72 feet (21m9) high, stand near the coast about 5 and 2½ cables, respectively, southward of the lighthouse. The black chimney of Tata oil mills, about 2¾ miles north-eastward of Cochin lighthouse, is visible over the tops of the palms; in fine weather, in the afternoon, this chimney can be seen from seaward for a distance of several miles.

Two beacons, each consisting of a white concrete pile, about 30 feet (9m1) high, stand about 3 miles north-westward and 4¾ miles north-north-westward of Cochin lighthouse and about 1¾ miles and three-quarters of a mile offshore.

Chart 65.

Port limits.—The southern and northern limits of the Port of Cochin extend 3 miles in a 270° direction from a boundary pillar and a white obelisk, respectively, situated on the coast 1½ miles southward and 6½ cables northward, respectively, of Cochin lighthouse. As the boundary pillar is hidden by coconut palms, a white corrugated iron beacon, 26 feet (7m9) high, has been erected close westward of it.

Charts 827, 70, 748b.

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Chart 65.

The western limit of the port is a line joining the western extremities of the southern and northern limits.

The port includes the harbour and backwater, with all creeks and channels leading thereto, and so much of the shores thereof, whether of the mainland or the islands, as are within 150 feet (45m7) of high-water mark, spring tides.

Pilots.—Government pilots are available at Cochin. They board vessels in the vicinity of Fairway light-buoy as indicated on the chart. Vessels can enter or leave the harbour by day or at night at practically any state of the tide.

A vessel awaiting a pilot should, if anchoring, lie about 2½ miles north-north-westward of Fairway light-buoy.

A vessel, stationed near the seaward end of the approach channel, is fitted with radio and will transmit and receive messages concerning pilotage only.

Pilotage is compulsory for all merchant vessels exceeding 100 tons burden, and it is advisable for masters of vessels under 100 tons burden and masters of all sailing vessels to employ the services of a pilot. Should the masters of such vessels not do so they must exercise the greatest caution when entering the inner harbour.

Pilots conduct all sailing vessels into the harbour irrespective of tonnage, upon the signal for a pilot being made.

The following regulations are in force regarding steam vessels when in charge of a pilot:—

Steam vessels will display on the foremast, when under way, a black ball or shape at least 2 feet (0m6) in diameter. This ball is to be displayed at the masthead when the vessel is proceeding at full speed and at other times at half mast.

All sailing vessels, cargo boats, vallams, ferries and launches are warned to keep clear of steam vessels displaying the above signal, and no launch or boat except those belonging to the harbour authorities shall go alongside any such vessels while the above signal is displayed.

Signal stations.—Storm signals.—A concrete signal tower, about 65 feet (19m8) in height and painted white on its seaward side, stands about one quarter of a cable south-south-westward of Cochin lighthouse (*Lat. 9° 58′ N., Long. 76° 14′ E.*); it is surmounted by a flagstaff, 124 feet (37m8) high, and is conspicuous. The signal station communicates with vessels by flags during daylight and by Morse code between sunset and sunrise.

For the convenience of vessels in the harbour and their agents, a signal station, connected to the telephone system, has been established on the water-tank tower situated at the northern end of Willingdon island and nearly 1½ miles east-north-eastward of Cochin lighthouse. Storm signals are displayed from the signal stations; the extended system is used. *See* page 20.

Port signals.—The following signals are displayed from the port jetty flagstaff on the southern side of the harbour entrance for the information of sailing vessels:—

International Code flag N indicates that a steamer is about to proceed out of harbour through the channel.

International Code flag F indicates that a steamer is about to enter harbour through the channel.

Dredging.—When at work a dredger will display two black balls,

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Chart 65.

disposed vertically, and, at night, will exhibit two *red* lights similarly disposed.

Firing practice.—A red flag by day and a *red* light at night will be shown at Fort Cochin when firing practice is in progress.

Pilot aboard.—*See* page 150.

Approach.—Dangers.—Spoil grounds.—Channel.—Buoyage.—Lights.—There are no outlying shoals or banks in the approaches to the port, with the exception of the shoal water of the bar, through which the deep approach channel has been dredged.

In 1958, it was reported that the depths on either side of the approach channel were up to 10 feet (3^{m}0) less than charted and that the 6-fathom (11^{m}0) line had extended about one mile westward.

The portion of the shoal area which lies on the northern side of the channel includes a spoil ground which is awash in places, and is indicated on the chart.

Southward of the channel a shoal, awash, on which the sea breaks, extends about 4½ cables westward from the lighthouse.

Another spoil ground lies on the southern side of the approach channel; it is marked by a yellow spherical buoy moored about 2½ miles west-south-westward of Cochin lighthouse.

A white spherical buoy, used in connection with swell observations, is moored about 2 miles westward of Cochin lighthouse (*Lat. 9° 58′ N., Long. 76° 14′ E.*).

The approach channel, 450 feet (137^{m}2) wide, has been dredged across the bar to the harbour entrance from a position about 2¾ miles west-north-westward of Cochin lighthouse. Vessels of up to 30 feet (9^{m}1) draught can use the channel.

Chart 749.

The approach to the dredged channel is marked by Fairway light-buoy moored about 3½ miles westward of Cochin lighthouse and about one mile westward of the seaward end of the channel.

Fairway can light-buoy, painted black and white in vertical stripes and surmounted by a double cross marked "Fairway", exhibits a *white flashing* light *every five seconds.*

Chart 65.

The northern side of the dredged channel is marked by Nos. 2, 4, 6 and 8 red can light-buoys, each exhibiting a *red flashing* light *every two seconds.*

The southern side of the dredged channel is marked by Nos. 1, 3, 5 and 7 black conical light-buoys, each exhibiting a *white flashing* light *every two seconds.*

Leading lights are exhibited:—the front light, at an elevation of 55 feet (16^{m}8), from a mast situated about 1½ miles east-north-eastward of Cochin lighthouse; and the rear light, at an elevation of 80 feet (24^{m}4), from a mast situated about 2¼ cables eastward of the front light-structure. These light-structures in line, bearing 081½°, lead through the harbour entrance.

Cautions.—On account of the shoal water on both sides of the approach channel, vessels should not attempt to enter or leave the channel when they are eastward of Fairway light-buoy unless they have a pilot aboard.

The bar is dangerous for ships' boats when the ebb tide is setting strongly against the sea breezes; it then causes a short choppy sea.

Charts 749, 827, 70, 748b.

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Chart 65.

Cochin harbour.—Depths.—Radio station.—Lights.—Within the harbour entrance the dredged channel is divided by Willingdon island, which lies with its north-western extremity about 1¼ miles east-north-eastward of Cochin lighthouse (*Lat. 9° 58′ N., Long. 76° 14′ E.*). Mattancheri channel leads westward of Willingdon island to the commercial port and Ernakulam channel leads eastward of the island to the oiling berths off Ernakulam and Naval jetty; the latter extends from the north-eastern side of Venduruthi island, which lies close south-eastward of Willingdon island, being separated from it by a canal.

The channels are liable to silt but are maintained by dredging. Vessels of up to 700 feet (213^{m}4) in length and 28 feet (8^{m}5) draught can berth at moorings in the harbour while the alongside berths can accommodate vessels of up to 550 feet (167^{m}6) in length and 30 feet (9^{m}1) draught.

The harbour office building, which is prominent and used as a leading mark for the approach channel, stands on the north-western end of Willingdon island together with the customs house. About three-quarters of a mile south-south-eastward of the customs house, on the western side of the island, is Cochin Harbour Terminus railway station. A road bridge, with a lifting span, connects the south-western extremity of Willingdon island with the mainland westward.

Venduruthi island, on which stand establishments of the Indian Navy, is connected with the mainland eastward by a rail and road bridge in the centre of which is a navigable opening marked by dolphins from which lights are exhibited.

There is a radio station on the north-western end of Willingdon island.

Mattancheri and Ernakulam channels.—Buoyage.—Berths.—Moorings.—Lights.—Within the harbour entrance the dredged channel is about 2 cables wide; its northern edge is marked by two red can light-buoys, each exhibiting a *red flashing* light *every three seconds.*

No. 1 swinging berth lies in this part of the channel about 3¼ cables north-westward of the customs house on Willingdon island.

Mattancheri and Ernakulam channels lead off this part of the channel on the western and eastern sides, respectively, of Willingdon island.

Mattancheri channel.—Mattancheri channel is maintained by dredging at a depth of 30 feet (9^{m}1) northward of the front leading light (*see* below). The dredged channel is about 1¼ cables wide.

The western side of the channel is marked by three black conical light-buoys, each exhibiting a *white flashing* light *every three seconds.*

The eastern side of the entrance to the channel is marked by a red can light-buoy, exhibiting a *red flashing* light *every two seconds.* Southward of the entrance the eastern side of the channel is marked by two red conical light-buoys, each exhibiting a *red flashing* light *every three seconds.*

Nos. 2 to 10 inclusive moorings lie on the western side of the channel between the two northern light-buoys marking that edge of the channel.

Nos. 11 and 12 moorings lie on the eastern side of the channel between the two southern light-buoys marking that edge of the channel.

On the western side of Willingdon island there are a number of

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Chart 65.

deep-water alongside berths. Passenger berth lies about 2 cables from the western extremity (*Lat. 9° 58′ N., Long. 76° 15′ E.*) of the island; berths A, B, C and D, each with a depth of 30 feet (9^{m}1) alongside, are situated abreast the railway station; and a coaling berth lies about one cable southward of D berth.

About 7 cables southward of D berth there is a dry dock (for details *see* Appendix I on page 343) and a slipway with a fitting out wharf, 300 feet (91^{m}4) in length and with a depth of 11 feet (3^{m}4) alongside.

Leading lights are exhibited on the eastern side of the channel from a position about midway between D berth and the dry dock; they are about 900 feet (274^{m}3) apart and, in line bearing 162¾°, lead through the centre of the channel abreast berths A, B, C and D.

Ernakulam channel.—Ernakulam channel is about half a cable wide in its north-western half and about 1½ cables wide in its south-eastern part. A depth of 30 feet (9^{m}1) is maintained by dredging northward of the southern end of Naval jetty (*see* below).

The north-eastern side of the channel is marked by Nos. 2, 4, 6, 8 and 10 red can light-buoys; Nos. 2, 4 and 6 light-buoys each exhibit a *red flashing* light *every two seconds* and Nos. 8 and 10 light-buoys a *red flashing* light *every three seconds.*

The south-western side of the channel is marked by Nos. 1, 3, 5, 7 and 9 black conical light-buoys, each exhibiting a *white flashing* light *every three seconds.*

In 1959, the bank off the north-eastern side of Willingdon island between Nos. 3 and 7 light-buoys was being reclaimed.

Two can-shaped mooring buoys, painted black and white in vertical stripes, with two similar buoys, painted black, between them, are moored off Ernakulam about 4 cables northward and 2 cables north-north-eastward of Naval jetty; they constitute three oiling berths in a depth of 30 feet (9^{m}1).

Close southward of Naval jetty, alongside the T-head of which a depth of 17 feet (5^{m}2) is maintained, there are two slipways and a smaller jetty.

There are numerous mooring buoys on the eastern side of the channel southward of the oiling berths.

A pair of leading lights (*Lat. 9° 57′ N., Long. 76° 17′ E.*) are exhibited on the eastern side of the channel about 4½ cables south-eastward of Naval jetty; the front light, at an elevation of 22 feet (6^{m}7), from a red and white framework tower, 25 feet (7^{m}6) in height; the rear light, at an elevation of 30 feet (9^{m}1), from a similar structure, 33 feet (10^{m}1) in height; the lights, in line bearing 141¼°, lead through the centre of the channel abreast the oiling berths.

Caution.—Caution is necessary when berthing at Naval jetty on account of the set and strength of the tidal streams. It was reported, in 1959, that the ebb stream sets strongly off, and the flood stream strongly on to, the jetty.

Channel for oil barges.—Light-buoys.—About 5 cables north-north-westward of Naval jetty is the entrance to a channel for oil barges, leading northward to Bolghatti island and the oil installations at the northern end of Ernakulam. This channel is marked by six white conical light-buoys, each exhibiting occasionally, a *white fixed* light.

Anchorages.—In the fine season the best anchorage outside the

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Chart 65.

port is about 3¼ miles offshore, with Cochin lighthouse bearing about 090°, in a depth of 6 fathoms (11m0), mud, good holding ground.

During the south-west monsoon the best position to anchor for communicating with Cochin depends entirely upon the position of the oily mud bank, which is constantly shifting, and which from its peculiar consistency is so stirred up by the swell as to break the force of the waves; in 1936, the position of the south-west monsoon anchorage was off Malipuram, about 3 miles northward of Cochin.

For anchorage for vessels awaiting a pilot, *see* page 150.

An anchorage is reserved for sailing vessels, including country craft, eastward of Vypin island, on the northern side of the entrance to the harbour. This area is marked by red conical buoys.

Tidal streams.—The maximum rate of the ebb stream at springs, throughout the year, is from 2 to 3 knots, and at neaps from three-quarters of a knot to 1¼ knots. The rate of the flood stream at springs, throughout the year, varies from 1½ knots to 2 knots, and at neaps from about three-quarters of a knot to 1¼ knots.

Both streams run for a considerable time after the predicted times of high and low water, from one to two hours on the flood, and from two to three hours on the ebb, according to the season.

After heavy inland rains the ebb stream may run continuously for many days, while the flood stream enters the harbour under the surface ebb. On very rare occasions, and after high inland floods, the tidal stream in the harbour may have a rate of 5 knots or more; this was observed in 1924.

In January and February the effect of the ebb stream is not noticeable westward of the outer channel buoys, and no appreciable current is experienced off the coast in the vicinity of Cochin.

In 1949, under monsoon conditions, strong eddies and cross currents were experienced in the habour entrance between Vypin island and Cochin, and also off the north-western point of Willingdon island.

Chart 749.

Directions.—When making Cochin (*Lat. 9° 58′ N., Long. 76° 14′ E.*) a vessel should keep in depths of not less than 6 fathoms (11m0) and westward of Fairway light-buoy; she should then hoist the signal for a pilot, and await him there.

Chart 65.

The harbour office building on the north-western end of Willingdon island, bearing 087°, leads through the dredged approach channel from Fairway light-buoy to the harbour entrance.

The leading lights, about 1¼ miles eastward of the harbour entrance, in line bearing 081¼°, lead from the eastern end of the approach channel through the entrance to the harbour.

On the ebb stream between the harbour entrance and the north-western end of Willingdon island there is a strong set across the channel from the northern part of the harbour; the limits of this stream are indicated by tide-rips which cause a vessel to sheer.

Towns.—The town of Cochin, comprising Fort Cochin and Mattancheri, lies on the northern end of the peninsula forming the southern side of the entrance to Cochin harbour. It contains several churches and public buildings. The population in 1951 was 73,908.

The town of Ernakulam, the headquarters of Ernakulam district, is situated on the eastern side of Cochin harbour; it contains the Govern-

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Chart 65.

ment offices, the Archbishop's palace and the main oil storage facilities of the port. In 1951 it had a population of 62,285.

The town of Vypin lies on the peninsula on the northern side of the harbour entrance.

Port facilities.—Large stocks of fuel and diesel oils and coal are maintained.

Fuel and diesel oils can be supplied by barge at any berth and by pipeline to vessels berthed alongside at Willingdon island or at the oiling berths at Ernakulam (*Lat. 9° 58′ N., Long. 76° 17′ E.*).

Coal can be supplied by barge or from shore to vessels berthed alongside at Willingdon island.

Fresh provisions of good quality can be obtained if a few days' notice is given. Fish is good and plentiful.

Drinking water can be supplied in barges of from 80 to 100 tons capacity, at the rate of from 300 to 500 tons per day on 24 hours' notice being given; it has to be brought from Alwaye river, which is subject to pollution, and, though already filtered, should be boiled before drinking. Water is laid on to the principal wharves.

There is a dry dock on the western side of Willingdon island (for details *see* Appendix I), and another one for small craft at the north-western end of Ernakulam.

Normal running and hull and engine repairs can be carried out.

There is one tug of 1,000 H.P. and six others of 250 H.P. or less.

About 350 lighters of from 30 to 80 tons capacity are available.

Seven 10-ton, one 3-ton and some 1½-ton cranes are available at the main berths on Willingdon island. One fixed 5-ton and four 2-ton travelling cranes are situated on Port wharf at Fort Cochin. There is a 30-ton floating crane.

Divers are available.

Seamen are admitted into the civil hospital.

There is a dispensary on Willingdon island, in charge of a resident medical officer.

Quarantine regulations.—During the prevalence of plague in Northern India vessels must obtain pratique before communicating with the shore. At other times there are no special regulations.

Trade.—Shipping.—The principal imports are mineral oils, coal, cashewnuts, manures, machinery and hardware. The main exports are iron ore, coir products, cashewnuts and kernels, tea, rubber and coconuts.

In 1957–58, 1,039 vessels with a total gross registered tonnage of 5,199,000 entered the port.

Communications.—There is regular communication by sea with Calcutta, the ports on the east and west coasts of India, Ceylon, Bombay and Karāchi, also with Europe and Australia.

There is an airport on Willingdon island from which there are daily services to Madras, Bombay and Trivandrum.

The railway terminus on Willingdon island is connected with the general railway system through Ernakulam.

Climatic table.—*See* page 48.

Charts 749, 750.

COAST.—General remarks.—The great estuary or backwater, on which Cochin (*Lat. 9° 58′ N., Long. 76° 58′ E.*) stands, extends for

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Charts 749, 750.

about 80 miles parallel to the coast from Alleppey, northward to Ponnáni, and has a breadth varying from 8 miles to a few hundred yards; it has channels communicating with other inland waters. It has a least depth of about 6 feet (1m8), and is affected by tidal influence.

Several rivers, which rise in the mountains 20 to 30 miles eastward, flow into this backwater, and render it brackish. The drainage of the extensive country, through which these rivers pass, increases greatly during the rains of the south-west monsoon; it enters the sea at Alleppey, Manakkadam, about 15 miles northward of Alleppey, Cochin, Pallippuram, Chetwayi and Ponnáni, and probably causes the constantly shifting soft mudbanks off this part of the coast. *See* page 147.

Chart 749.

The coast from Cochin to the entrance to Periyār river, about 13½ miles northward, is low, sandy and fringed with coconut trees. There is no elevated land near this coast which is densely populated.

In 1951, it was reported that the fathom lines off the coast between Cochin and Periyār river had extended considerably to seaward. The coast has also extended seaward in places to a distance of about half a mile.

Malipuram, about 3½ miles northward of Cochin, is a small open port and is under the superintendence of the Kerala State Port Officer. Almost all its exports and imports are now taken through the backwater to and from Cochin.

At the burst of the south-west monsoon there is always a swell and a surf on the coast, but after a lapse of about a week it becomes smooth, though there is a confused sea in the vicinity.

The entrance to Periyār river is generally conspicuous from the westward on account of the gap in the foliage; the bar can only be crossed by small vessels with local knowledge.

The smooth-water anchorage off the above stretch of coast depends entirely on the position of the oily mud bank (page 147).

Chart 827.

From Periyār River entrance (*Lat. 10° 11′ N., Long. 76° 10′ E.*) to Beypore, about 63 miles northward, the coast is low, sandy, fringed with coconut trees and devoid of conspicuous landmarks; thence to Mount Delly, about 60 miles farther northward, the coast is composed of sandy bays, with occasional slightly elevated rocky points. There are some hills inland of Beypore.

Mount Delly is a remarkable headland, 851 feet (259m4) high, with low sandy ground inland, which is less than 100 feet (30m5) in elevation at a distance of 2 miles from the mount; it then rises gently towards the Western Ghâts, attaining the same elevation as Mount Delly about 12 miles from it. *See* view [4].

The Kundah range lies about 10 miles inland between Calicut, about 4 miles northward of Beypore, and Tellicherry, about 34 miles northward of Calicut, and is higher here than on any other part of the coast; Vavul mala, 7,672 feet (2,338m4) high, about 23 miles east-northeastward of Calicut, is the highest and most conspicuous summit of this range.

The range inland of Tellicherry has several conspicuous peaks, the most western standing prominently forward only 10 miles eastward of that port; northward of them the high land recedes from the coast,

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Chart 827.

and the valley of Valapattanam (Valarpattanam) river occupies the area between them and the mountains of Coorg, which are far inland, and can only be seen in very clear weather.

Charts 749, 827.

Coast.—Beacons.—From the mouth of Periyār river the coast has a north-north-westerly direction for 39 miles to Ponnáni.

In the vicinity of Chetwayi (*Lat. 10° 32′ N., Long. 76° 03′ E.*) the coast is low, sandy and fringed with coconut trees, amongst which houses are visible at intervals About 15 miles eastward of Chetwayi is the foot of the mountains, but off that place it is difficult to make out any particular peak. About 18 miles east-north-eastward of Chetwayi there is a range of hills between the Western Ghâts and the coast; its highest part, more than 1,000 feet (30^{m}8) high, terminates abruptly towards the south.

Chart 749.

On a sandy spit, on the northern side of the entrance to the backwater on which Chetwayi is situated, there is a boundary pillar, 20 feet (6^{m}1) high, painted with two black and white horizontal bands; about 3 miles southward of this entrance, close to the coast, is another boundary pillar, 20 feet (6^{m}1) high, painted white. The existence of these pillars is doubtful.

The town of Chetwayi lies about half a mile within the entrance to the backwater.

Approaching Ponnáni river from the southward the southern entrance point, which is wooded, is prominent, and from the west-south-westward the extensive backwater forms a large gap in the line of trees.

A white boundary pillar, 27 feet (8^{m}2) high, stands on the coast, about one mile southward of the entrance to Ponnáni river and about 2 cables from the high-water mark; a similar pillar stands on a sand ridge, about half a mile northward of the entrance to the river and about 1½ cables from the high-water mark.

The bar of Ponnáni river has a depth of not more than 7 feet (2^{m}1), but small vessels with local knowledge can enter the river at high water.

There are some unlicensed pilots for this river.

Light.—A light is exhibited, at an elevation of 34 feet (10^{m}4), from a flagstaff at Ponnáni.

Anchorages.—A vessel can obtain anchorage, off the entrance to the backwater on which Chetwayi is situated, in a depth of 6 fathoms (11^{m}0), mud. Small vessels with local knowledge can enter the backwater at high water.

A vessel can anchor with the entrance to Ponnáni river open, about one mile offshore, in a depth of 5 fathoms (9^{m}1), mud.

Ponnáni.—The town of Ponnáni is situated on the southern side of, and half a mile within, the river entrance. It is a busy seaport for native craft, and the most important between Cochin and Beypore, but it is closed during the south-west monsoon. The port is in charge of a Port Conservator, subordinate to the Port Officer at Calicut. Boats for transferring cargo can be obtained.

The population, in 1951, was 23,606.

Storm signals.—There is a storm signal station at Ponnáni; the brief system is used. *See* page 20.

Communications.—Tirur station, on the Indian State railway, is

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Chart 749.

about 8 miles northward of Ponnáni (*Lat. 10° 47′ N., Long. 75° 55′ E.*).

There is occasional communication by sea with other ports on the Malabar coast, also with Colombo, Bombay and Karāchi.

Trade.—The principal exports are coconuts and coconut products and the imports, rice and salt.

Charts 749, 827.

Coast.—Dangers.—From Ponnáni the coast trends in a north-north-westerly direction for about 28 miles to Calicut (also known as Kozhikode), and is low and sandy; it is fringed with coconut trees, with red laterite hills in the background. Among the isolated hills, about 10 miles inland of Calicut, is Olayattur kunnu, about 800 feet (243m8) high. Urakuth mala is a good landmark for a vessel coming from the north-westward.

About 9 miles north-eastward of Ponnáni is a tableland, about 300 feet (91m4) high, with a few scattered trees on its summit; Urakuth mala, 1,565 feet (477m0) high, is situated about 20 miles north-north-eastward of Ponnáni.

Chart 827.

Vavul mala (page 156) can be seen in clear weather as soon as a vessel is on the bank of soundings, but in the hazy weather prevalent in March and April it is frequently indistinct from the anchorage off Calicut. The southern extremity of the Kundah range is rather abrupt, the mountains thence receding far eastward. For radar range *see* Appendix III on page 346.

About 11 miles north-westward of Vavul mala is Narikkot (Tanote Mullay), a mountain 5,090 feet (1,551m4) high.

Chart 749.

Tanniyurnagaram, about 12½ miles northward of the entrance to Ponnáni river, is an important fishing village. There is some tableland covered with coconut palms, about one mile north-eastward of the village.

Chart 64, plan of entrance to Beypore river.

The town of Beypore is situated on the north-western side of the entrance to Beypore river; it is connected with the railway and telegraph system. The port is included within the limits of the port of Calicut.

Unlicensed pilots are available.

Charts 64 with plan of entrance to Beypore river; 747.

Kotakunnu, 195 feet (59m4) high, situated about 3 miles south-eastward of the entrance to Beypore river, and a conspicuous single tree, the top of which has an elevation of 250 feet (76m2), standing about a quarter of a mile northward of the summit of Kotakunnu, are good marks for making Beypore. Other good landmarks are the flagstaff, 83 feet (25m3) high, on the south-eastern entrance point of Beypore river, a pillar, 19 feet (5m8) high, on the coast about 1½ miles northward of the flagstaff, and the chimneys of the tile works, about 1½ miles up the river. Another chimney, 190 feet (57m9) high and conspicuous, stands on the southern bank, opposite the tile works, and there is a conspicuous house, about three-quarters of a mile north-westward of the summit of Kotakunnu (*Lat. 11° 08′ N., Long. 75° 51′ E.*).

Chart 64, plan of entrance to Beypore river.

About half a mile southward of the river entrance there is a small

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Chart 64, plan of entrance to Beypore river.

bay; off the western point of this bay lies a reef containing Black rocks, 4 feet (1m2) high.

Two rocky patches, with least depths of 6 and 8 feet (1m8 and 2m4), respectively, lie about 2 cables apart about 1½ miles southward of the flagstaff on the south-eastern entrance point of Beypore river; a 5-foot (1m5) patch lies about 2¼ cables north-north-westward of the 8-foot (2m4) patch.

Chart 64.

At night a vessel in the vicinity of Beypore should not get into depths of less than 8 fathoms (14m6).

Beypore river is navigable at all seasons for a distance of about 20 miles from the coast; timber is floated down in large quantities from the forests.

Chart 64, plan of entrance to Beypore river.

The depth over the bar, in 1937, was about 6 feet (1m8), and depths not less than this amount can be carried as far as the town.

When it is not safe to cross the bar of the river owing to north-westerly winds and low water, good landing may be found in the small bay southward of Beypore.

Chart 64.

The entrance to Kallāyi river is about 4 miles northward of the entrance to Beypore river; the town of Calicut stands on the northern side of Kallāyi river.

Chart 64, plan of entrance to Beypore river.

Anchorages.—Anchorage can be obtained about 1¼ miles west-south-westward of the flagstaff on the south-eastern entrance point of Beypore river in a depth of 22 feet (6m7).

Chart 64.

Moderate-sized vessels usually anchor about 1¾ miles west-south-westward of this flagstaff in a depth of 28 feet (8m5). Large vessels anchor farther out.

CALICUT.—Calicut, also known as Kozhikode, was the first port in India visited by Europeans, the Portuguese having landed here in about 1498.

The city is the second largest in the State of Kerala and the headquarters of Kozhikode district; the chief suburb is West Hill, about 3 miles northward of the old town. In 1951, the population was 158,724.

The port (*Lat. 11° 15′ N., Long. 75° 46′ E.*) is in charge of a Port Conservator, who is also the Principal Port Officer of the State of Kerala. It has a very large native coasting trade; the foreign trade is also considerable. The port is practically closed from the beginning of June to the end of August.

Port limits.—Two white boundary pillars situated about 5 miles southward and 4 miles northward respectively of Calicut lighthouse (*see* below) mark the southern and northern limits of the port.

Landmarks.—A good landmark for Calicut, in the morning, is West hill, 127 feet (38m7) high, situated about 2 miles northward of Calicut lighthouse, with the houses on it showing amongst the trees. *See* view [5].

The dome of the Roman Catholic cathedral, 145 feet (44m2) in height, situated about 4½ cables south-eastward of Calicut lighthouse, is conspicuous.

Charts 827, 70, 748b.

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Chart 64.

Lights.—Calicut light is exhibited at an elevation of 52 feet (15m8) from a white masonry tower, 50 feet (15m2) in height, erected near the port office, at the northern end of the town. *See* view **[6]**.

Lights are exhibited, at elevations of 23 feet (7m0), from posts on the head of the southern and northern piers, respectively, situated about half a mile southward and close westward, respectively, of Calicut lighthouse.

Signal station.—Storm signals.—Communication with shipping is maintained by means of the International Code of Signals from a flagstaff near Calicut lighthouse. Morse code is used between the hours of sunset and 2400 and between 0400 and sunrise.

Storm signals are displayed from the signal station; the extended system is used. *See* page 20.

Dangers.—Buoyage.—Gillham rock, situated about 1¾ miles southward of Calicut lighthouse and about 6 cables offshore, has a depth of less than 6 feet (1m8) over it; about one quarter of a mile southward of the rock there is a depth of 10 feet (3m0). These are the southernmost dangers in the vicinity of Calicut.

Calicut reefs, the southern end of which lies about 2½ miles south-south-westward of Calicut lighthouse, extend for about 1½ miles in a northerly direction; they are a group of rocky shoals with a least depth of 2¼ fathoms (4m1) over them.

Coote reef, situated about 1½ miles south-south-westward of Calicut lighthouse and about 5 cables offshore, has a least depth of 3 feet (0m9) over it; a can buoy, painted black and white in vertical stripes, is moored about 3½ cables westward of Coote reef; the sea generally breaks over this reef. South-eastward of Coote reef and about one quarter of a mile offshore there is a rocky patch with depths of less than 6 feet (1m8) over it.

A rocky shoal, with a least depth of 4¾ fathoms (8m7), lies about 3 miles south-westward of Calicut lighthouse.

Anchorage reef, situated about 1¼ miles west-south-westward of Calicut lighthouse has a least depth of 2¼ fathoms (4m1) over it.

A can light-buoy, painted black and white in vertical stripes and exhibiting a *white flashing* light *every second*, is moored about 2½ cables west-north-westward of the western side of Anchorage reef. This buoy is liable to be washed away.

Within the 3-fathom (5m5) line northward of Coote reef there are several detached rocky shoals with depths of from 1¼ to 1¾ fathoms (2m3 to 3m2) over them; their positions can be best seen on the chart. A red conical buoy is moored off the eastern side of one of these shoals about half a mile south-westward of Calicut lighthouse.

Reliance shoal, a rocky shoal, the southern end of which is situated about 3½ miles westward of Calicut lighthouse, extends about 2½ miles in a north-north-westerly direction, and has a least depth of 28 feet (8m6); the bottom in the vicinity consists of soft mud.

A rocky islet, 6 feet (1m8) high, lies on the coastal reef, about 3 miles north-north-westward of Calicut lighthouse (*Lat. 11° 15′ N., Long. 75° 46′ E.*).

Two adjacent rocky shoals, with a least depth of 3¼ and 3½ fathoms (5m9 and 6m4) over them, lie about 1½ miles west-north-westward, respectively, from the above-mentioned rocky islet.

Anchorages.—Vessels usually anchor with the highest tree on

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Chart 64.

West hill bearing 043°, and Calicut lighthouse bearing 078°, in a depth of 4¾ fathoms (8m7), mud. A vessel should not anchor southward of this position, as the bottom is foul and rocky.

The light-buoy moored off the western side of Anchorage reef marks the southern and eastern limits of the anchorage for moderate-sized vessels off Calicut.

Small vessels with local knowledge can anchor southward and eastward of Coote reef in depths of about 2 fathoms (3m7), soft mud; they are partly protected from north-westerly winds by the reef.

When the sea breeze is strong it is found more convenient to ship cargo from the beach, abreast West hill, where the surf is more moderate than near the town.

Piers.—The northern and southern piers, the lights at the head of which have already been described, are each 775 feet (236m2) long, with depths of about 8 feet (2m4) alongside; they are fitted with cranes with lifting capacities up to 5 tons. These piers are used by lighters.

Landing.—Landing signals.—The following flags of the International Code of Signals are used:—

K.—Surf is impassable.

M.—Communication with the shore is dangerous.

N.—Boats can leave the harbour.

F.—Boats can enter the harbour.

There is a village situated about 3 miles northward of Calicut, having abreast it a bank of very soft mud, in consequence of which it is generally smoother on the beach here than at Calicut (*Lat. 11° 15′ N., Long. 75° 46′ E.*). This bank has been known on rare occasions to shift down the coast as far as Calicut, but it generally remains abreast this village.

Communications.—There is regular communication by sea with the ports on the east and west coasts of India, and with Ceylon.

Calicut is connected with the railway and telegraph systems.

A canal connects Calicut with Elattur River entrance, about 6½ miles north-north-westward.

Supplies.—Fresh provisions are obtainable in large quantities at three days' notice.

Water is supplied in casks, and is obtained from wells and tanks; it should be boiled and filtered.

Trade.—Shipping.—The chief exports consist of pepper, coir yarn, copra, timber, coconuts, oils, tea, rubber, coffee etc. The imports are grains, piece goods, hardware, machinery, metals and ores, motor cars and parts etc.

In 1958-59, 319 vessels with a total net registered tonnage of 574,615 used the port.

Port facilities.—In addition to the cranes on the piers, a 3-ton crane and several 1-ton cranes are available. Lighters are available in large numbers, also one tug.

There are two Government hospitals.

COAST.—Dangers.—Light.—Between Calicut (*Lat. 11° 15′ N., Long. 75° 46′ E.*) and Kadalur point, about 14½ miles north-north-westward, the coast is generally low, sandy and fringed with coconut trees, with red laterite hills in the background.

Elattur cape, about 4½ miles north-north-westward of Calicut light-

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Chart 64.

house, is low and rocky, with sandhills and coconut trees close inland.

Elattur river, the mouth of which lies about 1¼ miles northward of the cape, is shallow, rocky and navigable for boats only.

About 3 miles northward of the entrance to Elattur river good landing can be effected on the southern side of a large black rock, which has a tree on top of it.

About 9 cables north-westward of this rock and about 2 cables offshore is a reef, with a depth of less than 6 feet (1m8) over it.

Quilandi, about 2¾ miles northward of the large, black rock, is a considerable village, about 3 cables from the coast. Eastward and northward of Quilandi it is hilly and undulating. In the distant hills, the conspicuous summit of Palkunnu rises to an elevation of 972 feet (296m3), about 7½ miles east-south-eastward of the village.

Kollam, a village near the coast, about one mile north-north-westward of Quilandi, is fronted by a mudbank.

Kadalur point is low, but prominent, and covered with coconut trees, over which will be seen a large round tree; from this point hills rise gradually in a north-easterly direction, the nearest summit being Purakkad, which rises to an elevation of 254 feet (77m4), about 1¼ miles north-eastward of the point. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 180 feet (54m9), from a concrete tower, 114 feet (34m7) in height, situated about 4 cables inland on Kadalur point. *See* view [7].

The coastal reef, with depths less than 3 fathoms (5m5), extends about 1¼ miles southward and 1½ miles westward from Kadalur point; the western and south-western extremities of this reef are known as Trikodi reef and Kadalur reef; they have least depths of 1¼ and 2 fathoms (2m3 and 3m7), rock, over them, respectively. On the coastal reef there are rocks with depths of less than 6 feet (1m8) over them.

A 3¼-fathom (5m9) rocky shoal lies about 1½ miles southward of Kadalur point.

Drying rocks extend about 2¾ cables westward from a promontory, about 1¼ miles north-westward of Kadalur point.

About 2 miles north-north-westward of Kadalur point and close to the coast is the village of Tikkotti.

Sacrifice rock, 55 feet (16m8) high and conspicuous, is situated about 5 miles westward of Tikkotti village; it is composed of granite, and, having a white appearance, may be seen from a distance of 10 miles in clear weather.

Charts 64, 747.

The channel between this rock (*Lat. 11° 30′ N., Long. 75° 32′ E.*) and the mainland is free from dangers, but a vessel using it should keep near the rock, and not proceed into depths of less than 7 fathoms (12m8). A vessel passing westward of this rock during the night should not proceed into depths of less than 15 fathoms (27m4), which depths will be found about 2½ miles westward of the rock.

Chart 747.

About 4 miles northward of Tikkotti, at the mouth of Murat river, is the village of Kottakkal; there is a conspicuous round red hill, 180 feet (54m9) high, situated on the southern bank of this river, about one mile from the entrance.

Charts 827, 70, 748b.

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Chart 64.

Anchorage.—The bottom off Quilandi is soft mud, and the roadstead here is protected by a mudbank, so that small vessels can obtain secure anchorage. The coast is free from surf, and landing may be easily effected in ships' boats.

Chart 747.

Badagara.—Light.—Storm signals.—Badagara is an important town situated on the coast, at the northern extremity of Calicut backwater, about 8½ miles north-north-westward of Kadalur Point lighthouse. It is on the trunk road and railway from Calicut to Cannanore, which is situated about 20 miles north-westward of Badagara. The stretch of coast between Badagara and Cannanore is backed by undulating hills, about 400 feet (121m9) high, rising eastward to a range of mountains with remarkable and lofty peaks.

In 1951, the population of Badagara was 20,964.

The port is in charge of a Conservator, subordinate to the Port Officer at Calicut, and is open throughout the year. Cargo is worked during the south-west monsoon if the weather permits. Boats for cargo are obtainable.

A light is exhibited, at an elevation of 20 feet (6m1), from the port flagstaff at Badagara.

There is a storm signal station at Badagara; the brief system is used. *See* page 20.

Limits of port.—The limits of the port are two lines drawn in a 270° direction from two points on the coast, about 1¼ and 1½ miles northward and southward, respectively, of the custom house near the flagstaff, into depths of 9 fathoms (16m5).

Anchorage.—Anchorage can be obtained abreast Badagara, about 2 miles west-south-westward of the flagstaff, in a depth of 5 fathoms (9m1), mud.

Communications.—There is regular communication by sea with the ports on the coasts of India, and with Ceylon.

The town (*Lat. 11° 36′ N., Long. 75° 34′ E.*) is connected with the railway and telegraph systems.

Port facilities.—Fresh water is available in small quantities.

There is a hospital to which seamen are admitted.

Trade.—The principal exports are coconuts, copra, pepper and mango planks.

Coasts.—Dangers.—Between Badagara and Mahé, about 6¾ miles north-north-westward, the coast is sandy and fringed with coconut trees. Near the coast the country is undulating, with elevations of between 98 and 120 feet (29m9 to 36m5). Farther inland a conspicuous flat-topped hill rises to an elevation of 450 feet (137m2), about 3 miles east-north-eastward of Badagara. On either side of this hill, about 1¼ miles south-westward and one mile north-north-westward, respectively, are Kodakadu kunnu, 337 feet (102m7) high, and Tirumana, 329 feet (100m2) high.

In the distant hills of the Kundah range lie the conspicuous peaks of Nattavaram, 4,550 feet (1,386m8) high, and Banasuram (Buffaloes Hump), 6,755 feet (2,058m9) high, situated about 14½ miles northeastward and 20 miles east-north-eastward, respectively, of Badagara.

Muttungal is a village on the coast, about 2½ miles north-north-westward of Badagara; rocks extend about a quarter of a mile offshore, westward of the village.

Charts 827, 70, 748b.

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Chart 747.

Chombakulu, lying about 2¼ miles north-westward of Muttungal and about half a mile offshore, is an islet, about 10 feet (3m0) high; there are several rocks in this vicinity.

Mahé.—Dangers.—Light.—Mahé, the former French settlement, lies on the southern side of the entrance to Mahé river.

A light is exhibited, at an elevation of 80 feet (24m4), from a white mast, on a masonry base, 43 feet (13m1) in height, situated on the southern side of the entrance to Mahé river.

Rocks extend offshore, from both sides of the river entrance, into depths of 2 fathoms (3m7).

During the dry season the channel leading into the river is close to the rocks on the southern side of the entrance; the least depth in this channel is 2 feet (0m6), and the sea does not break over the rocks here; this channel is only available for small vessels with local knowledge.

The bar is considered dangerous, except when it is very smooth.

About one quarter of a mile from the entrance a road bridge spans the river.

The railway from Calicut to Tellicherry passes through Mahé.

The land behind Mahé consists of detached hills, on which there are some old forts and houses.

Mahé had a population, in 1948, of 18,293.

Anchorage.—Vessels can obtain anchorage west-south-westward of the light-mast, about 2½ miles offshore, in a depth of 5 fathoms (9m1), mud.

The harbour is a good one for small native craft, but it is only available for those with local knowledge.

Trade.—The exports are coconuts, pepper and dried fish. All descriptions of commodities are imported.

Kallāyi.—About a quarter of a mile up Mahé river, just above the bridge, is the port of Kallāyi, with a custom house. It has a considerable native trade.

Storm warnings.—Storm warnings are received at Mahé and Kallāyi but no signals are hoisted. *See* page 23.

Charts 1322, plan of Tellicherry anchorage; 747.

TELLICHERRY.—Tellicherry (*Lat. 11° 46′ N., Long. 75° 28′ E.*), lies about 3¾ miles north-westward of Mahé. The Fort, built in 1708, stands on the rising ground near the coast.

The following objects are conspicuous and easily identified:—The port office flagstaff, situated about one quarter of a mile south-eastward of The Fort; the club house, situated about one mile north-north-westward of The Fort; the southern port boundary pillar on Punuli point, about 2½ miles south-eastward of The Fort; and the ruins of a redoubt, which stand on the summit of a bare hill, 200 feet (61m0) high, about three-quarters of a mile north-north-westward of the club house.

The hills in the immediate vicinity of the town are thickly covered with coconut and other trees.

The port is in charge of a Conservator, subordinate to the Port Officer at Calicut; it is open throughout the year.

Chart 1322, plan of Tellicherry anchorage.

Port limits.—The limits of the port are two lines extending in a south-westerly direction into a depth of 9 fathoms (16m5) from the boundary pillar on Punuli point and the southernmost rocky point of

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Chart 1322, plan of Tellicherry anchorage.

Dharmapatam island, about 1½ miles north-westward of The Fort, respectively.

Signals.—Storm signals.—Communication with shipping is maintained from the port office flagstaff by day by means of the International Code of Signals and at night, between sunset and 2200 and between 0400 and sunrise, by Morse Code.

Storm signals are displayed from the port office flagstaff; the brief system is used. *See* page 20.

Lights.—A light is exhibited at an elevation of 89 feet (27m1) from a white masonry tower, 35 feet (10m7) in height, situated on the north-western bastion of The Fort. *See* view [8].

A light is exhibited at an elevation of 20 feet (6m1) from an iron post situated on the pierhead, about 3 cables south-south-eastward of Tellicherry main light (*Lat. 11° 45′ N., Long. 75° 29′ E.*). This light is unreliable.

Dangers.—Buoy.—Kurchikulu, situated about 4¾ cables westward of Punuli point is a rock with a depth of 3 feet (0m9) over it. Talayi rock, lying about 9½ cables north-westward of Punuli point and about 4¾ cables offshore, is a pinnacle rock, with a depth of 5 feet (1m5) over it; a small black spherical buoy, which is removed during the south-west monsoon, is moored off its southern side.

Nilot point, 11 feet (3m3) high, is situated about 1½ miles north-westward of Punuli point; foul ground and above and below water rocks extend about 3½ cables south-eastward and about 1½ cables north-westward from the point.

About 4½ cables south-westward of The Fort, and parallel with the coast, is a natural breakwater of basalt, 19 feet (5m8) high, named Bilikulu; between Bilikulu and the shore north-eastward are two similar, but shorter, ridges, 6 and 7 feet (1m8 and 2m1) high, respectively. These ridges, together with numerous detached rocks, above and below water, between Bilikulu and the shore, assist to shelter the landing at Tellicherry at low water during north-westerly winds, so vessels can often communicate with this port when all others are closed.

Shorukulu, 12 feet (3m7) high, is situated about 6¾ cables north-westward of Bilikulu, and is similar to it; there is foul ground between Shorukulu and the shore north-eastward.

Nakudiankulu, lying about 4½ cables westward of Shorukulu, is a pinnacle rock which dries 3 feet (0m9).

Caution.—Ballast must not be thrown overboard in depths of less than 10 fathoms (18m3).

Anchorages.—Large vessels should anchor some distance offshore, in depths of from 6 to 7 fathoms (11m0 to 12m8), when there is a probability of unsettled weather, but in the fine season a vessel can obtain anchorage south-westward of the lighthouse, about 1½ miles from Bilikulu, in a depth of 5 fathoms (9m1), soft mud.

Small vessels with local knowledge can obtain anchorage off Talayi, a village about 4 cables eastward of Nilot point; a vessel approaching this anchorage should pass southward of Talayi rock.

Town.—The main part of the town of Tellicherry (*Lat. 11° 45′ N., Long. 75° 29′ E.*) lies inland of, and southward of, The Fort. It had a population, in 1951, of 40,040.

Communications.—There is regular communication by sea with Colombo, Tuticorin, Alleppey, Cochin, Calicut, Cannanore, Mangalore,

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Chart 1322, plan of Tellicherry anchorage.

Bombay and Karāchi, also with ports on the east coast of India; there is also regular communication by sea with Europe.

Tellicherry is connected with the railway and telegraph systems.

Pier.—There is a pier with a T-head, near the port office, with landing steps on both sides. This pier, which is used by lighters, is 560 feet (170^{m}7) long, with depths of from 6 to 10 feet (1^{m}8 to 3^{m}0) alongside; it is fitted with one 5-ton and four 1-ton cranes.

Port facilities.—Good water is available and can be supplied in barrels. Fresh provisions are plentiful.

There is a Government hospital and dispensary to which seamen are admitted.

Trade.—The principal exports are pepper, coffee, tea, coconuts and timber, and the imports are rice, paddy, grains, sugar, salt, piece goods and metals.

Chart 747.

COAST.—Dangers.—Between Tellicherry and Cannanore, about 9 miles north-westward, the coast is formed of alternate cliffs and sandy beaches, fringed with coconut trees. The country inland, near the coast, is undulating, with elevations of between 100 and 200 feet (30^{m}5 and 61^{m}0).

Among the distant hills of the Kundah range are the conspicuous summits of Nattavaram peak, 4,550 feet (1,386^{m}8) high, about 17½ miles eastward of Tellicherry; Periya peak, 3,910 feet (1,191^{m}8) high, about 18 miles east-north-eastward of Tellicherry (*Lat. 11° 45′ N., Long. 75° 29′ E.*); and Perali mala, 1,602 feet (488^{m}3) high, about 13½ miles north-eastward of Tellicherry.

Chart 1322, plan of Tellicherry anchorage.

Kodali point lies about 1¼ miles north-north-westward of Tellicherry lighthouse on the southern side of the mouth of Kodali river. The entrance to this river, which extends about 12 miles inland, is blocked by a sandbar at low water.

Dharmapatam island is formed by a river which has its source in the Ghâts, about 32 miles inland; this river, on the eastern side of Dharmapatam island, is known as Dharmadam kadavu (Anjarkandi river), and on the western side of the island as Eta kadavu (Anjarkandi river). About 8½ cables northward of the southern extremity of the island, on a bare hill, 200 feet (61^{m}0) high, are the conspicuous remains of a redoubt, as already mentioned.

Dharmadam kadavu is used by native sailing craft for laying up during bad weather or for repairs; Eta kadavu is obstructed by a sandbar, over which the sea always breaks. Both channels are only navigable by small craft with local knowledge.

Between Shorukulu (page 165) and Green island, 1½ miles west-north-westward, there are numerous detached reefs and rocks, above and below water.

Green island, lying about 2 cables from the western point of Dharmapatam island, is covered with coconut trees, the tops of which, in 1932, were 113 feet (34^{m}4) high; it is fringed by a reef which extends about 2½ cables southward from its south-western end.

Chart 747.

Between Green island and Cannanore the coast is fringed by rocks, above and below water.

Charts 827, 70, 748b.

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Charts 1322, plan of Cannanore anchorage; 747.

CANNANORE.—On approaching Cannanore (*Lat. 11° 51′ N., Long. 75° 22′ E.*) the following objects are conspicuous and easily identified:—The flagstaff on Fort St. Angelo, an old Portuguese fort, which stands on a low rocky point at the southern end of the town; a clump of casuarina trees on the low hills, about 1¾ miles eastward of Fort St. Angelo; a chimney, 140 feet (42m7) high, about 7 cables west-north-westward of the flagstaff; and the two boundary pillars, situated about 1¾ miles east-south-eastward and one mile west-north-westward respectively, of the flagstaff.

A conspicuous headland, 60 feet (18m3) high, known as North point, lies about 4¼ miles north-westward of the flagstaff.

Chart 1322, plan of Cannanore anchorage.

The port and customs office is on the northern side of Moplah bay, the bight eastward of Fort St. Angelo.

The port is in charge of a Conservator, subordinate to the Port Officer at Calicut; it is closed to native sailing craft from the beginning of June to the end of August, but vessels can work cargo during the south-west monsoon, weather permitting.

Port limits.—The limits of the port are two lines extending in a 270° direction from the two boundary pillars, mentioned above, into depths of 9 fathoms (16m5).

Signal station.—Storm signals.—Communication with shipping is carried out from the flagstaff on Fort St. Angelo.

Storm signals are displayed from this signal station; the brief system is used. *See* page 20.

Light.—A light is exhibited, at an elevation of 78 feet (23m8), from the steel mast of the flagstaff, 52 feet (15m8) in height, situated on the northern bastion of Fort St. Angelo.

Anchorage.—Buoy.—Anchorage can be obtained about 1¾ miles south-westward of the steel mast of the flagstaff (*Lat. 11° 51′ N., Long. 75° 22′ E.*), in depths of about 5 fathoms (9m1), mud, good holding ground.

A red conical buoy is moored 4½ cables south-eastward of the light-mast, to mark the approach to the inner anchorage for native craft.

Rifle range.—Caution.—The eastern limit of the danger area of Cannanore rifle range is indicated on the chart by a pecked line drawn in a south-south-westerly direction from Cannanore light-structure; vessels anchoring westward of this line should take up an anchorage at least 1½ miles offshore. During firing practice a red flag is displayed at the butts, close westward of Fort St. Angelo.

Landing.—Landing can be effected in ships' boats in Moplah bay, on the beach facing the port and customs office, thus avoiding the rocks, awash, farther eastward, or, in fine weather, at the steps on the eastern side of the rocky point near Fort St. Angelo; when the south-west monsoon blows strongly a heavy swell renders landing impracticable.

Town.—Cannanore is a cantonment with barracks and the headquarters of Cannanore district. The old town, northward of Moplah bay, is almost completely hidden by coconut trees. In 1951, the population was 42,431.

Communications.—There is regular communication by sea with Colombo, Tuticorin, Alleppey, Cochin, Calicut, Tellicherry, Mangalore, Bombay and Karāchi, also with ports on the east coast of India.

Charts 747, 827, 70, 748b.

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Chart 1322, plan of Cannanore anchorage.

Cannanore is connected with the railway system, also with the general telegraph system.

Port facilities.—Small quantities of water, which must be boiled and filtered, can be obtained from wells on the beach, north-eastward of the fort; it is supplied from lighters by means of casks.

Fresh provisions and fruit are abundant.

Lighters are available.

There is a good hospital, to which seamen are admitted.

Trade.—The exports are black pepper, sandalwood, coconuts, coir yarn, coir fibre, fish manure and fish guano; coffee and cashew-nuts are exported during the south-west monsoon. The imports are rice, paddy, piece goods, twist, grains, groceries, hardware, salt, sugar, dates, soap and machinery parts.

Charts 746, 747.

COAST.—Between Cannanore (*Lat. 11° 51′ N., Long. 75° 22′ E.*) and Mount Delly, about 13 miles north-westward, the coast is low, sandy and fringed with coconut trees.

Charts 746, 747, 827.

Valapattanam (Valarpattanam) river, the mouth of which is situated about 7¼ miles north-westward of Cannanore, rises in the Western Ghâts, and joins, at the foot of the hills, another large stream flowing from the range in the north-eastern part of Monatuna.

Azhikal (Azhikkal) lies on the southern bank of Valapattanam river about 3 miles from its mouth; it is not visible from seaward. The town, which, in 1958, had a population of about 5,000, has a custom house but the post and telegraph office is at Azhikode (Alikkod), about 1¼ miles south-westward.

The port is in charge of a Deputy Conservator, subordinate to the Port Officer at Calicut. It has a thriving timber trade, the timber being floated down the river from the Coorg and Mysore forests.

At its mouth Valapattanam river is joined by Taliparamba (Mâttûl) river from the northward, the entrance being marked by a clump of casuarina trees on its northern side. The confluence of these rivers forms a sandy bar with a least depth of 6 feet (1^{m}8). The bar at the entrance to Valapattanam river has a least depth of 4 feet (1^{m}2).

As the channel is subject to seasonal changes, vessels should not attempt to cross the entrance bar except in very good weather, without the services of the unlicensed local pilots who can be obtained from Azhikal by telegraph.

Boundary pillars stand on the coast about 1¼ miles north-westward and 8 cables south-eastward respectively, of the river mouth.

Mount Delly, 851 feet (259^{m}4) high, is the summit of a conspicuous headland, which is separated from the low-lying mainland by a narrow creek; the south-western extremity of this headland is a bluff point joined by a low neck to the mount, and having on it an old fort, Kotte Kunnu (Yeli redoubt), 169 feet (51^{m}5) high. *See* view [4]. For radar range *see* Appendix III on page 346.

There are no off-lying dangers on this part of the coast, and vessels can proceed safely into depths of 5 fathoms (9^{m}1).

Anchorages.—A vessel can obtain good anchorage off the mouth of Valapattanam river, about 2 miles offshore, in depths of from 4½ to 5 fathoms (8^{m}2 to 9^{m}1), sand and mud, good holding ground.

Charts 827, 70, 748b.

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Charts 746, 747, 827.

Moderate shelter from north-westerly winds may be obtained with the summit of Mount Delly, bearing 330°, distant 2½ miles, in depths of 4 fathoms (7m3), mud.

Charts 746, 747.

Small vessels with local knowledge may find convenient shelter off the mouth of the creek, off the south-eastern side of the headland of which Mount Delly (*Lat. 12° 02′ N., Long. 75° 12′ E.*) is the summit, during the north-westerly winds which prevail here from February until May, in depths of from 2 to 2½ fathoms (3m7 to 4m6). A slight southerly set will be found here, and a short confused sea.

Storm signals—There is a storm signal station at Azhikal; the brief system is used. *See* page 20.

Charts 827, 70, 748b.

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CHAPTER V

MALABAR COAST.—MOUNT DELLY TO RIO TEREKHOL, INCLUDING THE PORTUGUESE TERRITORY OF GOA

Charts 746, 827.

GENERAL REMARKS.—Between Mount Delly and Bhatkal, about 120 miles north-north-westward, the Malabar coast (page 6) is backed by the Western Ghâts, which lie between about 15 and 25 miles inland. The northern portion of this range is a clearly defined watershed with few passes or prominent heights; the southern part, on the contrary, is intersected by deep valleys with forest-clad spurs. The highest peak on this stretch of coast in Kudremukh (Kudure Mukha), 6,204 feet (1,891^{m}0) high and situated about 67 miles northward of Mount Delly.

Westward of the Ghâts, a broken laterite plateau slopes gradually towards the sea, the plain at its base being strewn with boulders and miniature ranges of hills. The larger rivers of the district run through the valleys thus formed, producing backwaters near the coast.

Chart 746.

COAST.—Dangers.—From Kotte Kunnu (Yeli redoubt) (*Lat. 12° 00′ N., Long. 75° 12′ E.*) the coast trends in a north-north-westerly direction for about 55 miles to Mangalore. It presents a fringe of coconut palms, broken only by the mouth of a river or a prominent headland. The rivers of this district, though numerous, are of no great extent, being raging torrents in the south-west monsoon, and shallow streams during the dry season.

Kavvāyi puzha flows through Kavvāyi backwater into the sea on the north-western side of the headland of which Mount Delly is the summit; it is only available for boats.

Kavvāyi backwater, close within the coast, extends from abreast Mount Delly parallel to the coast for about 11¼ miles to the confluence of Karingote and Nilēshwar rivers, where they flow into the sea; this entrance is only used by native craft.

Hosdrug fort, about 6¾ miles northward of the entrance to Karingote river and about three-quarters of a mile from the coast, is a conspicuous ruin, 122 feet (37^{m}2) high; about 2¼ miles north-eastward of it lies a bare hill, 585 feet (178^{m}3) high, known as Manjampadi.

The South Indian railway, which runs along the coast westward of Hosdrug fort, and terminates at Mangalore, is visible from seaward at several places between the fringe of palm trees.

Bekal, about 5¾ miles north-westward of Hosdrug fort, is a small open port for native craft; it is formed by a rocky promontory on which there is an old fort, with a central bastion, 128 feet (39^{m}0) high. There is a rest house at the southern end of this promontory, and a

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Chart 746.

large prominent tree about one mile north-north-eastward of Bekal fort.

A group of rocks, 3 feet (0m9) high, lies about 1½ miles north-westward of Bekal fort and about 6 cables offshore.

The entrance to Chandragiri river, about 6 miles north-north-westward of Bekal, lies between the two hill forts of Chandragiri and Kāsaragod; these forts are 147 and 175 feet (44m8 and 53m3) high, respectively. The bar of Chandragiri river dries, and is subject to frequent change; it is only available for small native craft at high water.

There is a large conspicuous chimney, 135 feet (41m2) high, at Kāsaragod, a large village on the northern side of the entrance to Chandragiri river; the village is connected with the railway and general telegraph system.

Two posts, 20 feet (6m1) in height, each surmounted by a white ball, are erected, periodically, near the mouth of Chandragiri river, to mark the northern and southern limits of the port of Kāsaragod; they are removed, annually, during the south-west monsoon.

There is an old fort at Kumbla, a village on the southern side of the mouth of Shiriya river, situated about 6 miles northward of Kāsaragod; the entrance to the river changes every year during the south-west monsoon, and is only used by native craft. The village is connected with the railway system.

Passodigumphe, 1,062 feet (323m7) high, about 6¼ miles north-eastward of Kumbla (*Lat. 12° 35′ N., Long. 74° 56′ E.*), is a sloping mountain with a nearly level summit, the actual summit being on the southern side of the level top. Mudipina Padavu, about 8½ miles north-north-westward of Passodigumphe, is 682 feet (207m9) high. Both Passodigumphe and Mudipina Padavu are conspicuous and form good landmarks.

Manjēshvar, about 7 miles north-north-westward of Kumbla, is a small customs port with little or no trade.

Storm warnings.—Storm warnings are received at Kāsaragod but no signals are hoisted. *See* page 23.

MANGALORE.—Mangalore, about 8½ miles north-north-westward of Manjēshvar, is the headquarters of South Kanara district. Its principal industries are tile-making, hand weaving and coffee curing. The population, in 1951, was 117,083.

Landmarks.—Light.—When approaching Mangalore the following objects are conspicuous and easily identified:—The summits of Passodigumphe and Mudipina Padavu, mentioned above; Kodinjackal, a rugged, double-peaked hill, 1,143 feet (384m4) high, situated about 18 miles north-eastward of the town; and Kudremukh.

The hills at the back of Mangalore are undulating and separated from each other by valleys, through which rivers flow from the mountains.

Chart 3267, plan of Mangalore harbour.

The town of Mangalore is almost entirely concealed from seaward by trees, but from the offing the following objects are conspicuous:—South Port Boundary pillar, a white truncated conical pillar 30 feet (9m1) in height, standing about half a mile southward of the harbour entrance; the Port Officer's flagstaff, 101 feet (30m8) high, and Mangalore light-structure (*see* below) situated close together about half a mile east-north-eastward of the harbour entrance; the dome,

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Chart 3267, plan of Mangalore harbour.

surmounted by a spire, of the Roman Catholic cathedral, 133 feet (40^{m}5) high, situated about half a mile northward of Mangalore light-structure; and the square tower of St. Aloysius college, 249 feet (75^{m}9) high, standing about 1¼ miles north-north-eastward of the cathedral.

Mangalore light (*Lat. 12° 51′ N., Long. 74° 50′ E.*) is exhibited, at an elevation of 33 feet (10^{m}1), from a white masonry tower and dwelling, 37 feet (11^{m}3) in height and resembling a small chapel. *See* view [9].

Signal station.—Storm signals.—There is a signal station close to Mangalore light-structure through which communication is maintained with vessels anchored off the harbour.

Storm signals are displayed from this signal station; the extended system is used. *See* page 20.

Harbour and entrance.—Buoys.—The inner harbour is situated in the backwater formed by the confluence of Gurpūr and Netrāvati rivers; it is closed from about mid-May to mid-September during which period there is no communication with the shore.

The harbour entrance, about 2 cables wide, lies between two low sandy spits; it is fronted by a bar which is subject to constant change; in 1950, vessels were recommended to cross the bar with the Port Officer's flagstaff bearing 071°, which then lead in a least depth of 7 feet (2^{m}1).

In the entrance between the sandspits there are depths of over 30 feet (9^{m}1), but inside the harbour the depths decrease rapidly and are subject to constant change; a considerable part of the backwater dries.

In 1950, there was a narrow channel, marked by two buoys, with a least depth of 7 feet (2^{m}1), leading from the harbour entrance to the wharves northward of the port office. Another channel, marked by a single buoy, with a least depth of 4 feet (1^{m}2), led from the harbour entrance to the railway bridge across Netrāvati river. These channels are only navigable by boats with local knowledge.

Charts 3267, plan of Mangalore harbour; 746.

Anchorage.—Vessels can anchor about 1¼ miles off the harbour entrance, in a depth of 5 fathoms (9^{m}1), with Mangalore lighthouse bearing between 050° and 100°, distant about 2 miles. A vessel should not close to within a distance of 1½ miles from Mangalore lighthouse (*Lat. 12° 51′ N., Long. 74° 50′ E.*) between these bearings, as the depths decrease rapidly shorewards of this limit.

Chart 3267, plan of Mangalore harbour.

Port facilities.—The port is operated by the Mangalore Port Trust Board.

No bunkers are available.

Moderate supplies of fresh provisions are obtainable. Very small quantities of fresh water can be supplied in tanks.

About 50 lighters, with an average capacity of 35 tons, are available. There are some cranes with capacities up to 5 tons.

Minor repairs only can be carried out. There is a dry dock for port craft.

The hospital and civil dispensary are open to seamen.

Trade.—Shipping.—The main exports are tiles, bricks, betel nuts, pepper and timber. The imports are coir yarn, rice, grains, hardware, piece goods and sugar.

In 1958-59, 190 powered and 3,317 sailing vessels with a total tonnage of 535,500 used the port.

Charts 746, 827, 748b.

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Chart 3267, plan of Mangalore harbour.

Communications.—Radio.—There is a regular weekly passenger service by sea with Bombay, except during the south-west monsoon, and occasional communication with Colombo, Tuticorin, Cochin, Karāchi and other coastal ports.

There is an airport at Bajpe about 16 miles from Mangalore.

Mangalore is connected with the railway system, and with the general telegraph and telephone systems.

There is a radio station at Mangalore. *See* page 24.

Charts 746, 745.

COAST.—Dangers.—From Mangalore the coast trends in a north-north-westerly direction for about 31 miles to Malpe, a town of some importance, situated on the northern side of the entrance to Udiyāvara river.

Between Mangalore and Suratkal point, about 9¾ miles north-north-westward, the coast is straight, sandy and fringed with coconut trees. There is a temple on Suratkal point (*Lat. 13° 00′ N., Long. 74° 48′ E.*), and some trees, 110 feet (33^{m}5) high.

From Suratkal point to Malpe, about 21 miles farther north-north-westward, the coast continues straight and fringed with coconut trees.

A rock, 4 feet (1^{m}2) high, lies about half a mile southward of Suratkal point and about a quarter of a mile offshore, and several rocks, one of which is 4 feet (1^{m}2) high, lie close north-westward of the point.

A rock, 6 feet (1^{m}8) high, lies about 1½ miles north-north-westward of Suratkal point, and about 1¼ cables offshore.

Mūlki river, the entrance to which is about 4 miles northward of Suratkal point, is of little importance; the bar almost dries.

A white masonry pillar, 20 feet (6^{m}1) in height, marks the southern boundary of the port of Mūlki.

The town of Mūlki has a church, on high ground, about 1¼ miles north-north-eastward of the entrance to the river.

Chart 745.

Light.—A light is exhibited, at an elevation of 140 feet (42^{m}6), from a masonry tower, 117 feet (36^{m}6) in height, situated on a rock on the coast, about 9½ miles north-north-westward of the entrance to Mūlki river. This lighthouse is called Kāp (Cahp) lighthouse. *See* view [10].

The ruins of Kāp battery stand near the lighthouse.

Off-lying dangers.—Mūlki rocks, situated about 4 miles south-westward of Kāp lighthouse and about 3¾ miles offshore, are of black basalt, some of them being 40 feet (12^{m}2) high. Vessels in this vicinity at night should not proceed into depths of less than 13 fathoms (23^{m}8).

A 2¼-fathom (4^{m}1) rocky shoal lies 2½ miles south-westward of Kāp lighthouse.

Storm warnings.—Storm warnings are received at Mūlki but no signals are hoisted. *See* page 23.

Coast.—Dangers.—From Kāp lighthouse, a ledge of rocks extends in a north-westerly direction for a distance of about half a mile, inside which landing can generally be effected.

A rock, 2 feet (0^{m}6) high, is situated about 1½ miles west-north-westward of Kāp lighthouse and about 1¼ miles offshore; a rock, which dries 5 feet (1^{m}5), lies close north-eastward of it.

Kāp (Cahp) rock, about three-quarters of a mile north-north-east-

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Chart 745.

ward of the 2-foot (0m6) high rock, and about the same distance offshore, is 40 feet (12m2) high and prominent.

Outer rocks, situated about 2 miles north-westward of Kāp rock, and about 1¾ miles offshore, are a group of prominent rocks, some of which are 40 feet (12m2) high.

Black rocks, which lie about three-quarters of a mile north-north-eastward of Outer rocks and about 1¼ miles offshore, are another group of prominent rocks about 40 feet (12m2) high. Two rocks, 15 feet (4m6) and 9 feet (2m7) high, lie about a quarter of a mile west-south-westward and half a mile north-westward, respectively, of Black rocks.

Caution.—Vessels in the vicinity of Outer and Black rocks should not proceed into depths of less than 8 fathoms (14m6) by day, or into depths of less than 12 fathoms (21m9) by night.

Landmarks.—Kunjar Gudde (Kunjargudda), 340 feet (103m6) high, about 4 miles north-eastward of Kāp lighthouse, is a prominent landmark; inland, a range of mountains rises gradually, of which the best defined peak is Walkunji, 3,415 feet (1,040m9) high, shaped like a buffalo's hump, and situated about 17¾ miles east-north-eastward of Kunjar Gudde. *See* view on chart.

Chart 3267, plan of St. Mary isles and Malpe roads.

Malpe and approaches.—Islands and dangers.—The entrance to Udiyāvara river (*Lat. 13° 21′ N., Long. 74° 42′ E.*), which is liable to constant change, is about three-quarters of a cable wide, with depths of from 7 to 12 feet (2m1 to 3m7) inside the entrance. It is fronted by a bar over which there was a depth of 2 feet (0m6) in 1949. Boats can enter the river from a north-westerly direction.

A sandspit, which dries, extends about 3 cables west-north-westward from the southern entrance point of the river. This sandspit, and St. Mary isles, which front the entrance, afford some protection to the river mouth.

St. Mary isles, comprising Dārya Bāhādurgārh islands, Middle rock, Entrance rock and Coconut island are described below.

Dārya Bāhādurgārh islands consist of three islands:—South island, 47 feet (14m3) high, situated about one mile south-south-westward of the entrance to Udiyāvara river; Dārya Bāhādurgārh island, 53 feet (16m1) high, lying about 1¾ cables north-north-westward of South island; and North island, the south-eastern end of which is 51 feet (15m5) high, and on the summit of which stands Malpe lighthouse (page 175), which lies about one cable north-westward of Dārya Bāhādurgārh island. *See* view [11].

A rock, with a least depth of 12 feet (3m7) over it, lies about 2 cables south-south-eastward of South island.

There are a number of rocks in the channels between the above islands but they should not be attempted except by small craft with local knowledge. The channel to the eastward of Dārya Bāhādurgārh islands, and between them and the sandspit extending westward from the mouth of Udiyāvara river had, in 1950, a least depth of 12 feet (3m7) over a width of half a cable.

A rocky ledge, on which stand several rocks the northernmost of which is 25 feet (7m6) high, extends about 1½ cables north-westward from the northern extremity of North island; a rock, with a depth of 11 feet (3m4) over it, lies about three-quarters of a cable west-north-westward of the northern extremity of this rocky ledge. Foul ground,

Charts 827, 748b.

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Chart 3267, plan of St. Mary isles and Malpe roads.

with rocks above and below water, and shoal patches, extends 3 cables westward from North island.

Entrance rock, 4 feet (1m2) high, is situated about 7½ cables northward of Malpe lighthouse; a rock, which dries one foot (0m3), lies about one cable east-south-eastward of it.

Middle rock, 10 feet (3m0) high, lies about 2¼ cables northward of Entrance rock, to which it is connected by a ridge of above and below water rocks. Foul ground, with rocks above and below water, extends about 2½ cables north-westward, and 2 cables westward, from Middle rock. Adjakal rock, with a depth of one foot (0m3) over it, is situated about 3½ cables eastward of Middle rock; the sea breaks over it, but at high water this only occurs with westerly winds.

A rock, 2 feet (0m6) high, lies about one mile north-eastward of Middle rock and about 2 cables offshore; foul ground extends about 2 cables northward from this rock and between it and the shore.

A number of rocks, with depths of from 3 to 18 feet (0m9 to 5m5) over them, lie between Middle rock and Coconut island and to the northward and eastward of Adjakal rock.

Coconut island (*Lat. 13° 23′ N., Long. 74° 40′ E.*) is situated about one mile north-north-westward of Middle rock. It is well wooded, the trees being about 86 feet (26m2) high. The island stands on a reef which extends about 2 cables south-eastward and one cable north-north-westward from the island.

Foul ground, with several above-water rocks, the highest of which is 26 feet (7m9) high, extends about 6½ cables west-north-westward from the north-western extremity of the island. A rock, which dries 6 feet (1m8), lies close off the north-western edge of this foul ground.

Landing.—Landing is not generally possible on the seaward side of St. Mary isles, but can be effected, in moderate weather, on the eastern sides of Coconut island, North island and Dārya Bāhādurgārh island, where there are short stretches of sand. Care is, however, necessary, as there are a number of rocks near the low-water line. At the mouth of Udiyāvara river, which is comparatively sheltered, landing is nearly always possible. Elsewhere on this open coast landing is only practicable in calm weather.

Lights.—A light, known as Malpe light, is exhibited at an elevation of 59 feet (18m0) from a grey stone tower, 16 feet (4m9) in height, situated on the summit of North island, about one mile westward of the entrance to Udiyāvara river. *See* view [12].

Leading lights are occasionally exhibited:—the front light at an elevation of 15 feet (4m6) from a mast, surmounted by a white square topmark, situated on the coast about a quarter of a mile westward of Malpe; and the rear light at an elevation of 35 feet (10m7) from a mast, surmounted by a white diamond topmark, situated about one cable eastward of the front light-structure. These lights in line, bearing 097°, lead between Dārya Bāhādurgārh islands and Entrance rock.

Anchorages.—Anchorage can be obtained in a depth of 5 fathoms (9m1), mud, about one mile west-north-westward of Malpe lighthouse.

Small vessels can anchor in a depth of 20 feet (6m1), sand and mud, with Malpe lighthouse bearing 185° and Malpe chimney (*see* below) bearing 104°, and also in a depth of 20 feet (6m1), sand and mud, about 5 cables eastward of the summit of South island.

Small craft can obtain anchorage with shelter from westerly winds,

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Chart 3267, plan of St. Mary isles and Malpe roads.

in depths of from 12 to 14 feet (3m7 to 4m3), sand and mud, in the channel eastward of North and Dārya Bāhādurgārh islands.

Town.—Landmarks.—Storm signals.—The small town of Malpe is situated on the northern side of the entrance to Udiyāvara river; it is connected by road with Udipi, a larger town, about 3 miles eastward of it.

A prominent chimney, 85 feet (25m9) high, stands about 4 cables east-north-eastward of the entrance to Udiyāvara river. A flagstaff, 38 feet (11m6) high, is situated about one cable north-westward of the chimney.

Two small boundary pillars stand about 2½ cables northward and 2¼ cables south-eastward, respectively, of the mouth of the river.

Storm signals are displayed at Malpe; the brief system is used.

See page 20.

Chart 745.

Coast.—Dangers.—Storm signals.—From Malpe (*Lat. 13° 21′ N., Long. 74° 42′ E.*) the coast trends in a northerly direction for about 17½ miles to Kundapur, and from thence in a similar direction for about 14 miles to Baindūr (Baidur) head, the northern entrance point of Baindūr river.

This coast presents a fringe of coconut trees broken only by the mouths of rivers, which will be presently mentioned. Northward of Kundapur the coast is low and sandy.

About 20 miles inland, the Western Ghāts extend northward and roughly parallel to the coast as far as latitude 13° 40′ N., where the range trends in a general direction north-westward, closing the coast.

From a position about 1¾ miles north-westward of Coconut island a chain of rocks, above and below water, extends in a north-north-easterly direction for about 3½ miles; these rocks lie from 2 to 2¾ miles offshore. Northward of these rocks there are no dangers off-lying the coast as far northward as Kundapur.

Sitānadi (Barkur) river flows into the sea, about 7 miles northward of Malpe; the bar is very shallow.

Hangarkatta (Hangarkota) is the port at the mouth of Sitānadi river. There is a considerable trade in rice and paddy. North and south boundary pillars, about one mile apart, are established at Hangarkatta.

Kundapur is situated at the junction of Hālādi (Kundapur) and Chakranadi (Chakra) rivers. It has regular communication by sea with Bombay.

Storm signals are displayed at Kundapur; the brief system is used. Storm warnings are received at Hangarkatta but no signals are hoisted.

See pages 20 and 23.

A chain of rocks extends about 1¾ miles west-south-westward from the entrance to Hālādi and Chakranadi rivers; Pate rock, at the western edge of this foul area, dries 4 feet (1m2), and the sea always breaks over it. A rock, 8 feet (2m4) high, lies about 2 cables north-eastward of Pate rock, with another rock, 12 feet (3m7) high, about midway between it and the shore.

The bar across the entrance to Hālādi and Chakranadi rivers is constantly altering. In 1936, there was a depth of 6 feet (1m8) over it, and steering for the entrance, bearing 045°, led over the bar in the deepest water. A dangerous surf breaks over the bar with westerly winds, and on the ebb tide.

Charts 827, 748b.

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Chart 745.

For a distance of about 3½ miles northward of the entrance to Hālādi and Chakranadi rivers foul ground, with rocks above and below water, extends about 1¼ miles offshore; for a distance of about 5 miles northward of this there are no off-lying dangers.

Yedamavina river, with a bar at the entrance, flows into the sea, about 10¾ miles northward of the entrance to Hālādi and Chakranadi rivers; it is of no commercial importance.

Nancowry rock, lying about 4 miles westward of the entrance to Yedamavina river, consists of two rocky shoals lying close together, the western with a depth of 1¾ fathoms (3m2) over it, and the eastern with a depth of 4¾ fathoms (8m7); between Nancowry rock and the coast are several rocks; amongst these is a rock, 9 feet (2m7) high, situated about 2 miles south-westward of the entrance to Yedamavina river, and another, 20 feet (6m1) high, close northward of the entrance to this river (*Lat. 13° 49′ N., Long. 74° 37′ E.*).

Aspect.—Kodachādri, about 14¾ miles eastward of the entrance to Yedamavina river, is a magnificent sugar-loaf peak, 4,411 feet (1,344m5) high, standing isolated and conspicuous; when bearing more than 090° it is obscured by Male Gudda (Yelgudda), 2,957 feet (901m3) high, 8¾ miles westward.

Besides Kodachādri the most prominent peaks in this vicinity are Male Gudda; Madalbarē Gudda (Karnigudda), 3,383 feet (1,031m1) high, about 2 miles northward of Male Gudda; Devarkonda (Devakonda), 3,614 feet (1,101m5) high, about 2½ miles east-north-eastward of Madalbarē Gudda; Chalkin Barē (Chalkinbarra), about 1¾ miles west-north-westward of Devarkonda, 3,020 feet (920m5) high, and Yadamale Gudda (Yedamale), 2,766 feet (843m1) high, about 4½ miles north-westward of Chalkin Barē.

Coast.—Baindūr is a small port, used by native craft, situated on the eastern side of the entrance to Baindūr river; the bar across the entrance to this river has depths of from one to 2 feet (0m3 to 0m6).

Baindūr head is 200 feet (61m0) high and cliffy; this point, the termination of a tableland which extends some distance inland, is conspicuous from seaward.

Lights.—A light is periodically exhibited, at an elevation of 13 feet (4m0), from an iron post, 8 feet (2m4) in height, situated on a wharf just westward of the custom house at Hangarkatta. This light is, however, unreliable.

A light is exhibited, at an elevation of 45 feet (13m7), from a steel mast, 40 feet (12m2) in height, situated about 9 cables southward of the entrance to Hālādi and Chakranadi rivers.

Anchorages.—The best anchorage off Kundapur is with the light-structure bearing 101°, distant about 1½ miles, in a depth of 4½ fathoms (7m8).

Small vessels with local knowledge can obtain anchorage on the northern side of the entrance to Hālādi and Chakranadi rivers in comparatively deep water.

In approaching the anchorage off Kundapur from the northward Pate rock, during the day, can be identified by the breakers, but at night a vessel should not proceed into depths of less than 7 or 8 fathoms (12m8 or 14m6) until the light bears 096° or less. The entrance to the river can only be identified when bearing less than 090°.

Charts 827, 748b.

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Chart 745.

Storm warnings.—Storm warnings are received at Baindūr but no signals are hoisted. *See* page 23.

Charts 744, 745.

Coast.—Dangers.—Northward of Baindūr head (*Lat. 13° 52′ N., Long. 74° 36′ E.*) the coast, though generally sandy and fringed with coconut trees, is in some parts rocky, with bold headlands and several islets off it. Within the coastline is a narrow strip, from 5 to 15 miles wide, of flat land; inshore of this are some smooth-topped hills, with elevations of from about 200 to 300 feet (61m0 to 91m4), occasionally crossed by the densely wooded and rugged spurs of the Western Ghāts. The coastline is broken by the estuaries of Sharāvati (Honawar) river, about 27½ miles northward of Baindūr head; Aghnāshini (Tadri) river, about 14½ miles north-north-westward of the mouth of Sharāvati river; Gangāvali (Gangawali) river, about 6 miles north-north-westward of the mouth of Aghnāshini river; and Sadāshivgarh (Sadashivgad) or Kālinadi river, about 17½ miles north-westward of the mouth of Gangāvali river.

The coast shows as detached parts of tableland, easily identified as such in the morning, when the mist hangs in the valleys; scattered here and there are round hills of about equal elevation.

Between Baindūr head and Huddi point, about 6 miles north-north-westward, the coast is low and sandy.

Huddi point is a cliffy promontory, rising to an elevation of 170 feet (51m8), about half a mile inland; there is a small rounded hill, 114 feet (34m7) high, situated on the extremity of the point.

Between Huddi point and Bhatkal lighthouse, about 1¼ miles north-north-westward, there are cliffs from 150 to 200 feet (30m5 to 61m0) high.

Two White rocks, 14 feet (4m3) high, lie close together about 4 miles west-north-westward of Baindūr head and about 3¼ miles offshore; they are very prominent when the sun is on them. A rock awash lies about three-quarters of a mile south-south-eastward of these rocks, and there are several shoals, with depths of from 3 to 5 fathoms (5m5 to 9m1), in their vicinity. Single White rock, 8 feet (2m4) high, rounded and steep-to, is situated about 1¾ miles northward of Two White rocks and about 2 miles offshore.

Although the locality inside these dangers has been examined and numerous dangers found, it is possible that others may exist there. A vessel should therefore not attempt to pass inside them, and is recommended to keep in depths of more than 10 fathoms (18m3) between Kundapur and Shiral or Hog island, about 4 miles north-westward of Bhatkal lighthouse.

Bhatkal fort, on the ruined site of which stands Bhatkal lighthouse, is situated on a rocky point, 142 feet (43m3) high, at the entrance to a river; the channel over the bar of this river is very narrow, practically dries and is only available for boats.

Caution.—Buoys.—A 10-foot rocky shoal lies about one mile south-south-westward of Bhtakal lighthouse; it is marked on its western side by a red barrel buoy. A vessel approaching Bhatkal from the southward should not attempt to pass between this rocky shoal and the shore. There are numerous rocky patches in the approaches to Bhatkal, amongst which are two, each with a depth of 16 feet (4m9) over them, and another with a depth of 14 feet (4m3) over it, which lie about

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Charts 744, 745.

1¼ miles west-south-westward, one mile southward and 7 cables westward, respectively, from Bhatkal lighthouse; a conical buoy, painted black and white in horizontal bands, is moored off the north-western side of the first-mentioned patch.

Town.—The town of Bhatkal is situated on the northern bank of the river, about 1½ miles north-eastward of Bhatkal lighthouse. Local vessels call regularly and a small trade is carried on.

Coast.—Between Bhatkal lighthouse (*Lat. 13° 58′ N., Long. 74° 32′ E.*) and the entrance to Venkatapur river (Venketpur creek), about 4 miles north-north-westward, the coast is low and sandy, and foul ground extends about 1¾ miles offshore.

Shiral or Hog island, situated about 4 miles north-westward of Bhatkal lighthouse, and about 1¾ miles offshore, is a peaked island, 356 feet (108m5) high. Two rocks, each drying 4 feet (1m2), are situated about a quarter of a mile south-eastward and close westward, respectively, of the island. A vessel in this vicinity should not proceed into depths of less than 10 fathoms (18m3).

Kerekund (Rocky islet), 60 feet (18m3) high, lies on the western edge of the coastal reef, about three-quarters of a mile north-north-eastward of Shiral.

A rock, 20 feet (6m1) high, is situated about half a mile south-eastward of Kerekund, and another rock, 8 feet (2m4) high, lies about half a mile north-north-eastward of Kerekund and about three-quarters of a mile offshore.

Venkatapur river is shallow and only available for small vessels with local knowledge.

Off-lying island.—Netrani or Pigeon island, situated about 8¾ miles westward of Shiral, is wooded and flat-topped, with a prominent summit, 331 feet (100m9) high; it is steep-to, except for a rock, 50 feet (15m2) high, which lies about 3 cables south-westward of its southern end, and a 1¾-fathom (3m2) rocky shoal lying about 1½ cables eastward of the eastern extremity of the island. For radar range *see* Appendix III on page 346.

Lights.—Fog signal.—Storm signals.—A light is periodically exhibited, at an elevation of 184 feet (56m1), from a square masonry tower, 55 feet (16m8) in height, situated on the ruined site of Bhatkal fort. An auxiliary light is exhibited, at an elevation of 120 feet (36m6), from the same tower. A fog signal is sounded from the lighthouse.

These lights are obscured by Shiral between bearings 129° and 132°.

Storm signals are displayed from a flagstaff, 185 feet (56m4) high, close eastward of the lighthouse; the brief system is used. *See* page 20.

Anchorages.—Anchorage can be obtained in a depth of 5½ fathoms (10m1), with Bhatkal lighthouse bearing 075°, distant one mile. If coming from the northward the summit of Shiral should not bear less than 006° until Bhatkal lighthouse bears 090°, when course may be altered for the anchorage.

A small vessel, with local knowledge, may obtain anchorage in 4 fathoms (7m3), sand and shell, with Bhatkal lighthouse bearing 014°, distant 2½ cables. This anchorage should be approached on a course 087° from the position of the outer anchorage, described above, passing 2 cables southward of the rocky patch, with a depth of 14 feet (4m3) over it, situated about 7 cables westward of Bhatkal lighthouse.

Charts 827, 748b.

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Charts 744, 745.

A vessel might obtain a little shelter off the south-eastern side of Pigeon island, during north-westerly winds, in a depth of 15 fathoms (27m4), mud.

Caution.—A vessel intending to close the port of Bhatkal should not proceed into depths of less than 10 fathoms (18m3) without local knowledge.

Coast.—Dangers.—Buoy.—From the entrance to Venkatapur river the coast trends in a north-north-westerly direction for about 31 miles to the entrance to Agnāshini river, and is for the most part low and sandy with occasional rocky points.

The 8-foot (2m4) high rock lying half a mile north-north-eastward of Kerekund (*Lat. 14° 01′ N., Long. 74° 29′ E.*), and about one mile north-westward of the entrance to Venkatapur river, has been previously mentioned.

Chart 744.

Murdeshwar (Modeshwar) is an islet, 99 feet (30m2) high, with an old fort on the summit, situated close offshore, about 4 miles northward of Kerekund. It is connected with the mainland by a drying reef.

A rocky island, 27 feet (8m2) high, lies about three-quarters of a mile south-westward of Murdeshwar. It is situated near the western edge of foul ground, with rocks above and below water, which extends westward from the coast in this vicinity.

Dart rock, situated about 1¾ miles west-south-westward of Murdeshwar, has a least depth of 9 feet (2m7) over it; it is marked on its western side, from October to May, by a spherical buoy, painted black and white in vertical stripes; the sea only breaks over this rock in heavy weather.

Māvalli is a village situated on the coast, close eastward of Murdeshwar; it stretches along the coast for about one mile on either side of this position.

Hawkins reef, which is awash, extends in a south-westerly direction from the coast about 1¼ miles northward of Murdeshwar; the south-western edge of this reef is about one mile offshore.

About 6½ miles northward of Murdeshwar is the southern end of a ridge which extends along the coast for about 2 miles, and attains an elevation of 502 feet (153m0); it is covered with brushwood, which is remarkable in contrast with the sandy beach; the cliffs at its base are 150 feet (45m7) high and are prominent.

Behind this ridge about 3 miles north-eastward of Murdeshwar stands the prominent summit of Kotagudda, 1,430 feet (435m9) high. It is saddle-shaped and connected by intervening and lower hills with a long sharp ridge which extends south-eastward about 2 miles farther inland; this ridge is particularly noticeable from the southward.

The long flat summit of Hudelgudda, 1,690 feet (515m1) high, lies about 6½ miles south-eastward of Kotagudda, and is easily identified.

The estuary of Sharāvati (Honawar) river, which is extensive, is situated about 11½ miles north-north-westward of Murdeshwar, and 3 miles north-north-westward of the 150-foot (45m7) cliffs already mentioned. The bar is dangerous and no reliable directions can be given for entering the river, on account of the changes that are constantly taking place. In 1959, there was a least depth of 5 feet (1m5) over the bar, but it should not be crossed by boats at low water due to heavy breakers.

Charts 827, 826, 748b.

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Chart 744.

The town of Honāvar (Honawar) (*Lat. 14° 16′ N., Long. 74° 27′ E.*) is situated on the northern side of Sharāvati river, about three-quarters of a mile within its entrance. It is of some importance, having a considerable export of timber and betelnuts. Local steamers call frequently during the fine season. The town is connected to the telegraph system. In 1948, the population was about 10,000.

On a hill, 140 feet (42^{m}7) high, behind the town there is a conspicuous monument, 36 feet (11^{m}0) in height.

Haravalli, about 7 miles eastward of Honāvar, is 1,764 feet (537^{m}7) high, is isolated and easily identified, as are also the 400-foot (121^{m}9) summit of Ravana Gundy (*see* below) and Kasaragode, 410 feet (125^{m}0) high, which lie about 5 miles north-north-westward and 3½ miles south-south-westward, respectively, of Honāvar monument.

Basavrājdurg (Basradrug) island, 180 feet (54^{m}9) high and conspicuous, is situated about 2½ miles north-north-westward of the entrance to Sharāvati river. It lies about half a mile offshore, is covered with trees and brushwood and has the ruins of an ancient fort belonging to one of the kings of Carnatic on it. *See* view [13].

Indravati patch, about 6 cables westward of Basavrājdurg, is a rocky shoal with a depth of 2½ fathoms (4^{m}6) over it. A 2¾-fathom (5^{m}0) patch lies midway between Indravati patch and Basavrājdurg.

Ravana Gundy, a rocky headland, with two summits, 400 feet (121^{m}9) and 340 feet (103^{m}6) high, respectively, lies about 2½ miles northward of Basavrājdurg. When seen from the westward it appears saddle-shaped and shows up well at night. The village of Dhareshwar (Dareshvar) is situated about half a mile inland from the headland.

Kaltiguda, 2,221 feet (677^{m}0) high, situated about 8 miles eastward of Ravana Gundy, is the highest peak of a small mountain range trending in an east-north-easterly direction. It is conspicuous and an excellent landmark in clear weather. *See* view [13].

Bambikauguda, a wedge-shaped hill, 400 feet (121^{m}9) high, lies about 2½ miles north-north-eastward of Ravana Gundy. It can be identified by its reddish colour.

Kumta (Kumpta) point, about 3½ miles north-north-westward of Ravana Gundy, is the northern entrance point of a creek.

Kumta (Kumpta) about 1½ miles east-north-eastward of Kumta point, is the chief commercial town in North Kanara district; it is connected with the general telegraph system. Local vessels call here frequently.

Snail rock, situated about 1¾ miles north-westward of Kumta point and about three-quarters of a mile offshore, is 20 feet (6^{m}1) high, and owes its name to its resemblance to a snail when seen from northward; a rock awash lies about half a mile northward of Snail rock and about three-quarters of a mile offshore.

Pagoda hill or Deviti Guda, 100 feet (30^{m}5) high, lies close to the coast about 3½ miles northward of Kumta point. The pagoda, which stands on this summit, forms a prominent landmark when approaching Kumta from the northward.

Paryat Gudi (Danson peak), situated about 6¾ miles north-eastward of Pagoda hill, is 1,902 feet (579^{m}7) high and conspicuous. Spike hill, 1,613 feet (491^{m}7) high, lies about three-quarters of a mile north-north-westward of it. *See* view [13].

Kudi Gudda (Motigudda), 1,087 feet (331^{m}3) high, about 3½ miles

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Chart 744.

west-north-westward of Paryat Gudi, is prominent from the westward, and can be identified by its dome-shaped appearance.

Achuvi Moti Gudda, 2,740 feet (835m1) high, about 5 miles north-north-eastward of Paryat Gudi, is a prominent sugar-loaf summit, standing well back from the coast. *See* view **[13]**.

Lights.—A light is periodically exhibited, at an elevation of 105 feet (32m0), from a mast, 50 feet (15m2) in height, situated about 6 cables south-westward of the monument at Honāvar. The light is obscured by trees on certain bearings.

A light is exhibited, at an elevation of 108 feet (32m9), from a lantern on a white iron circular hut, 12 feet (3m7) in height, situated on Kumta point (*Lat. 14° 25′ N., Long. 74° 23′ E.*).

Storm signals.—Storm signals are displayed at Honāvar and Kumta point; the brief system is used. Storm warnings are received at Murdeshwar but no signals are hoisted. *See* pages 20 and 23.

Anchorages.—Good anchorage may be obtained with the monument at Honāvar bearing 082°, distant 2½ miles, and the summit of Basavrājdurg island bearing 353°, in a depth of 5 fathoms (9m1), sand and mud.

A small vessel with local knowledge may obtain anchorage, with shelter from strong north-westerly winds, between the coast and the eastern side of Basavrājdurg island, in depths of 2½ fathoms (4m6). Such a vessel can also obtain anchorage southward of Kumta point in depths of from 3 to 3½ fathoms (5m5 to 6m4), sand and mud; the point affords some shelter from north-westerly winds.

Small craft can enter the creek on the southern side of Kumta point at high water, but it is too shallow for them to remain there.

Chart 744, plan of entrance to Tadri river.

Aghnāshini river.—Beacons.—Aghnāshini (Tadri) river is only navigable for a short distance. Small boats can proceed as far as Kagal, a distance of 12 miles; there is a least depth of 9 feet (2m7) on the bar but as it is subject to change vessels should not attempt to enter without local knowledge.

Flagstaff hill rises to an elevation of 440 feet (134m1) about 6 cables north-north-westward of the north-western entrance point.

A fort, known as Rajaman Drug, is situated at an elevation of 300 feet (91m4) on the south-eastern entrance point.

Two leading beacons, about one cable apart, stand on the summit of a hill, 410 feet (125m0) high, about half a mile north-eastward of Rajaman Drug.

The town of Tadri lies on the north-western side of the river, about one mile within the entrance. A pier projects from the shore at the southern end of the town. In 1948, the population was about 1,000.

There is a boat channel, available at high water, close to the northern shore of the river entrance.

Light.—A light is exhibited, at an elevation of 85 feet (25m9), from a white iron column, 20 feet (6m1) in height, on the north-western entrance point of the river (*Lat. 14° 31′ N., Long. 74° 21′ E.*).

Dangers.—Foul ground, with rocks above and below water, extends about 2¼ cables southward from the north-western entrance point of the river, on which the light-structure stands.

A shoal patch, with rocks 8 feet (2m4) high, known as Gull rocks, lies about 4½ cables north-eastward of the light-structure.

Charts 827, 826, 748b.

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Chart 744, plan of entrance to Tadri river.

Anchorage.—Anchorage may be obtained about 1½ miles south-westward of the bar, with the leading beacons, described above, bearing 070°, and the western extremity of the coast bearing 320°, in a depth of 4½ fathoms (8m2), mud.

Communications.—There is regular communication by sea with Tadri.

Chart 744.

Coast.—Dangers.—Beacons.—From the entrance to Aghnāshini river the coast trends about 2 miles westward to a promontory, 216 feet (65m8) high, and thence north-north-westward for about 4½ miles to the entrance to Gangāvali (Gangawali) river.

For about 1¾ miles northward of Aghnāshini river the coast is cliffy, but from thence it is low, sandy and fringed with coconut trees. The town of Gokarn, where there are several large temples, is situated close northward of the junction between the cliffs and the low, sandy beach.

A few miles inland, behind the sandy beach, several hills rise to elevations of between 300 and 400 feet (91m4 and 121m9). Among the more distant and higher mountains is the conspicuous summit of Achuvi Moti Gudda, 2,740 feet (835m1), previously mentioned, and situated about 10 miles north-eastward of Tadri. *See* view [13].

Two rocks, 20 feet (6m1) and 6 feet (1m8) high, lie about half a mile south-eastward and quarter of a mile north-north-westward, respectively, of the western extremity of the promontory mentioned above.

A hill, 446 feet (135m9) high, is situated about three-quarters of a mile north-eastward of the above promontory; there is a conspicuous tree about half a mile north-north-westward, and another hill, 378 feet (114m2) high, about three-quarters of a mile north-north-eastward of it.

The well-defined and isolated summit of Handegadda, 1,015 feet (309m4) high, is situated about 4½ miles east-north-eastward of the entrance to Gangāvali river.

Gangāvali river is shallow, and the channel is encumbered by sandbanks.

About half a mile north-north-westward of the entrance to Gangāvali river there is a rocky headland, the cliffs of which extend along the coast north-north-westward for about 1¾ miles to a table-topped hill, 147 feet (44m8) high, known as Kusuldiva Gudda (*Lat. 14° 38′ N., Long. 74° 16′ E.*), on the north-eastern side of which is a bight encumbered with rocks.

An area of foul ground, with rocks above and below water, extends half a mile south-westward from the coast, about half a mile south-south-eastward of Kusuldiva Gudda; a rock, which dries 3 feet (0m9), lies close north-westward of the western extremity of this foul ground.

Two rocks, 5 feet (1m5) and 7 feet (2m1) high, lie close northward and about half a mile northward, respectively, of Kusuldiva Gudda.

Storm warnings.—Storm warnings are received at Gokarn but no signals are hoisted. *See* page 23.

Belekeri roads.—Aspect.—Dangers.—Beacons.—Belekeri roads lie between Kusuldiva Gudda (guda) and Kwada Gudda (Kawda guda), about 6¾ miles north-westward. It is the anchorage for vessels embarking iron ore, which is transported to them by lighters from Kandāni halla (Belekeri creek), the entrance to which lies on the northern side of Belekeri (Belikeri) point, about 5 miles northward of Kusuldiva Gudda.

Charts 827, 826, 748b.

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Chart 744.

Belekeri (Belikeri) bay lies between Belekeri point and Kwada Gudda.

Tulsiparwat, a black conspicuous peak, rises to an elevation of 1,709 feet (520^{m}9), about 6½ miles north-eastward of Kusuldiva Gudda. *See* view [13].

Conical hill, a conspicuous summit, 1,226 feet (373^{m}7) high, and so named from its remarkable appearance, lies about 2 miles north-westward of Tulsiparwat.

Belekeri point is low, flat and rocky with a large and prominent bungalow among the trees eastward of the point.

The low valley of Kandāni halla extends north-eastward for several miles and is in striking contrast to the high land on either side. The undulating land northward of Kwada Gudda (*Lat. 14° 42′ N., Long. 74° 12′ E.*) attains elevations of more than 1,800 feet (548^{m}6).

Belekeri (Belikeri) hill, 1,590 feet (484^{m}6) high, is situated at the south-western end of a range, which rises near the coast, about 2½ miles northward of the mouth of Kandāni halla, and extends north-eastward. Dauglish peak, 1,822 feet (555^{m}3) high, is the highest summit in this range and lies about 3 miles north-eastward of Belekeri hill. *See* view [13].

Belekeri hill is prominent from the southward and westward.

About 1½ miles south-eastward of Belekeri hill, and three-quarters of a mile inland, are the conspicuous twin peaks of Aversa hills, 373 and 409 feet (113^{m}8 to 124^{m}7) high.

Kwada Gudda is a steep rocky headland, which rises to an elevation of 709 feet (216^{m}1) at Kwada Gudda hill; the latter is conspicuous and lies about three-quarters of a mile north-westward of the south-eastern extremity of the headland.

Ankola creek, the entrance to which dries, lies about 2 miles northward of Kusuldiva Gudda. A small islet lies close westward of the entrance to the creek. Namazguda, 145 feet (44^{m}2) high, is situated on the southern shore of the entrance. The town of Ankola, in which there are several temples, is situated about one mile eastward of the mouth of the creek.

Between Kusuldiva Gudda and Belekeri point foul ground, on which there are several rocks which dry, extends three-quarters of a mile offshore in places.

A rocky ledge, foul ground and shoal water extend about one mile south-eastward and half a mile southward from Belekeri point. Two rocks, awash, lie near the western end of the foul ground.

A small islet, which is fringed by a reef on its north-western side, lies close south-westward of Belekeri point.

Kandāni halla and its entrance are rocky. Two beacons are situated on rocks at the entrance to this creek; the southern beacon is surmounted by a diamond and the northern one by a square. The channel into this creek, which is only available for a small vessel with local knowledge, leads between these beacons. A least depth of 3 feet (0^{m}9) exists at the mouth of the creek.

Kukra islet, which is wooded, conspicuous and 178 feet (54^{m}2) high, lies about one mile west-north-westward of Belekeri point. *See* view [13]. A rock, which dries 4 feet (1^{m}2), lies close southward of the islet.

A rock, with less than 6 feet (1^{m}8) of water over it, lies about 1½ miles northward of Kukra islet.

Charts 827, 826, 748b.

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Chart 744.

Anchorages.—In 1959, I.N.S. *Jumna* reported that Aversa hills in line with Kukra islet provided a good transit for vessels to anchor in Belekeri roads according to draught.

Belekeri bay (*Lat. 14° 42′ N., Long. 74° 13′ E.*) affords anchorage to small vessels with local knowledge in its northern part, with shelter from north-westerly winds, in depths of from 2 to 3 fathoms (3^{m}7 to 5^{m}5).

Communications.—Trade.—There is no township at Belekeri roads, the nearest village being Aversa about 2 miles north-eastward of the entrance to Kandāni halla. Aversa lies on the main highway between the town of Kārwār (page 189), northward, and Ankola, southward; it is connected to the loading site on Kandāni halla by road.

Large quantities of iron ore from the mines in the Hospet-Bellary area of the interior are exported from Belekeri roads; in 1959-60, more than a million tons were exported.

Moderate quantities of general cargo are imported and exported by sailing vessels.

Storm warnings.—Storm warnings are received at Ankola but no signals are hoisted. *See* page 23.

Charts 242, 744.

Coast.—Dangers.—Guddehalli, 1,805 feet (550^{m}2) high, situated about 6 miles west-north-westward of Belekeri hill, is conspicuous, and appears from the southward, together with the adjacent summit, as a saddle-shaped hill. *See* view [13].

A sharp peak, known as Golikodlu peak, rises to an elevation of 1,800 feet (548^{m}6), about 3 miles eastward of Guddehalli.

Aurigi cape, 556 feet (169^{m}5) high, lies about 3¼ miles north-westward of Kwada Gudda. The bight formed in the coast between these two points is known as Kwada (Kawda) bay.

Manzel creek, which enters the sea in the north-western corner of Kwada bay, extends inland from Aurigi cape in a general north-easterly direction. Its valley and the low-lying land to the north-westward give the cape the appearance of an island.

Button rock is small, black and 20 feet (6^{m}1) high, situated about 1½ miles south-south-westward of Aurigi cape. A rock, 6 feet (1^{m}8) high, lies about one mile north-eastward of Button rock. *See* view [13].

Aurigi islet, which is wooded and 176 feet (53^{m}6) high, lies about 2 cables southward of Aurigi cape.

Chart 242.

Between Aurigi cape and Binge point, 219 feet (66^{m}8) high, about 2¾ miles north-westward, is a bight, named Binge bay.

A patch, with a depth of 1¾ fathoms (3^{m}2), lies in the middle of Binge bay about one mile east-south-eastward of Binge point.

Anjidiv island, which is Portuguese territory, lies 2 miles west-north-westward of Aurigi cape. There is a summit, 211 feet (64^{m}3) high, near its northern extremity, on which there are some coconut trees. On the north-eastern side there are some houses and the ruins of a fort, near which there is a flagstaff. The south-western side of the island is rocky and brown. A rock, with a depth of less than 6 feet (1^{m}8) over it, the position of which is approximate, lies about 1¼ cables south-eastward of the south-eastern extremity of the island.

Round islet (*Lat. 14° 45′ N., Long. 74° 08′ E.*), 87 feet (26^{m}5) high,

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Chart 242.

lies about half a mile north-eastward of the south-eastern extremity of Anjidiv, and is fringed by a reef.

Between Binge point and the southern extremity of Kārwār head, about 1½ miles north-westward, there are two small sandy bays; the south-western end of the promontory separating these two bays is named Baitkal point. On the north-eastern shore of the south-eastern bay is the village of Binge, and on the low-lying isthmus separating the north-eastern shore of the north-western bay from a cove, about a quarter of a mile north-eastward, is the village of Baitkal.

Kārwār head is covered with dense jungle, and attains an elevation of 677 feet (206^{m}4); the western extremity of this promontory is called Badchidhar point. *See* view **[13]**.

Mogeraguda island, the southern end of which is about 1½ miles west-north-westward of Baitkal point, is rocky, covered with jungle and attains an elevation of 181 feet (55^{m}2); a rock, 10 feet (3^{m}0) high, lies about half a cable south-westward, and a 2¼-fathom (4^{m}1) patch about 2½ cables south-south-westward, of the island.

There is a channel with moderate depths, and free from dangers, separating the north-eastern side of Mogeraguda island from Kārwār head, about 4 cables north-eastward.

Gudsar sunv, situated about 5½ cables west-north-westward of the north-western end of Mogeraguda island has a least depth of 1½ fathoms (2^{m}7) over it.

Anchorages.—Anchorage may be obtained off the north-eastern side of Anjidiv island in depths of 5 fathoms (9^{m}1), mud and sand; vessels have ridden out the south-west monsoon here, as the island forms an excellent breakwater; at that season a strong current sets south-eastward.

Binge bay affords shelter from north-westerly winds in its northern part to small vessels, in depths of from 3 to 4 fathoms (5^{m}5 to 7^{m}3).

KĀRWĀR AND APPROACHES.—Beacons.—The town of Kārwār, which is situated on the coast, about 2 miles eastward of Badchidhar point (*Lat. 14° 48′ N., Long. 74° 06′ E.*), is approached between this point and Loliem point, about 7½ miles north-north-westward; the bottom in this area is chiefly composed of mud.

Charts 242, 827, 826.

Between Badchidhar point and the entrance to Sadāshivgarh river, about 2¾ miles north-eastward, is a bight called Kārwār bay; the port of Kārwār lies at the southern end of this bay, and is reported to be the only safe port, except Mormugão about 41 miles north-north-westward between Cochin and Bombay.

Chart 242.

Coast.—Islands and dangers.—Buoy.—Oyster rocks are a conspicuous group of islands and rocks. Mandāl island, the southernmost of the group, is 20 feet (6^{m}1) high and lies with its south-eastern extremity about 2¼ miles west-north-westward of Badchidhar point. *See* view **[14]**.

Devgad island, 142 feet (43^{m}3) high, the south-western end of which is situated about one cable north-north-eastward of Mandāl island, has a lighthouse and several buildings on it; it is bold and rocky, and slopes gradually westward; the summit of the island is covered with jungle. There is a custom house here. The western side of Devgad island

Charts 744, 827, 826, 748b.

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Chart 242.

is almost steep-to; landing can be effected on the eastern side during fine weather.

Karkal island, 100 feet (30^{m}5) high, and covered with jungle, lies close eastward of Devgad island and is surrounded by foul ground.

East islet, a bare rocky islet, 30 feet (9^{m}1) high, lies about 3 cables eastward of Karkal island.

A rock, which dries 4 feet (1^{m}2), lies about one cable eastward of East islet; shoal water, with a least depth of three-quarters of a fathom (1^{m}4), extends about one cable south-south-eastward from this rock. The sea does not break over this rock at high water during the fine season.

Kūrmagad island (*see* below) is situated about 2¼ miles north-eastward of Karkal island.

Rammathguda, an isolated hill on the mainland, rises to an elevation of 238 feet (72^{m}5), about 1¾ miles north-eastward of Kūrmagad island.

The summits of Kūrmagad island and Rammathguda in line, bearing 036°, leads 2½ cables south-eastward of the dangers at the eastern end of Oyster rocks.

The eastern extremity of Mogeraguda island (*Lat. 14° 48′ N., Long. 74° 05′ E.*) in line with the western extremity of Anjidiv island, bearing 154°, leads about 1½ cables east-north-eastward of the dangers eastward of Oyster rocks.

Chart 242, with plan of Port Kārwār.

Nagakul point, the north-eastern extremity of Kārwār head, lies about half a mile eastward of Badchidar point.

Bluff point, about three-quarters of a mile east-south-eastward of Nagakul point, stands at the north-western corner of the entrance to Baitkal cove, where a small vessel, with local knowledge, can obtain secure anchorage.

Ambari sunv, a rock, 5 feet (1^{m}5) high, lies about half a cable offshore, about 3 cables eastward of Nagakul point; Baitkal rock, with a depth of one fathom (1^{m}8) over it, is situated about 3¼ cables east-south-eastward of Ambari sunv and about half a cable offshore; it is marked on its northern side by a black can buoy.

Chart 242.

The entrance to Sadāshivgarh (Sadashivgad) or Kālinadi river is much encumbered with sandbanks, some of which dry, and the channels change frequently.

The southern bank of the river is low. About a quarter of a mile eastward of the southern entrance point there is a small jetty, whence a ferry runs across to another jetty on the northern bank; close southward of this latter jetty there is a group of drying rocks, marked by iron beacons.

Sadāshivgarh (Sadashivgad) hill, on the summit of which are the ruins of an old fort, rises to an elevation of 218 feet (66^{m}4) on the northern side of the river just within the entrance; the ruins of another fort stand on a hill about a quarter of a mile eastward of Sadāshivgarh hill.

The town of Sadāshivgarh (Sadashivgad) lies close northward of these two hills.

There is ample shelter in the river for small vessels with local knowledge.

Sunghiri island, 139 feet (42^{m}4) high, lies about 3 cables south-

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Chart 242.

westward of Kūrmagad island. Foul ground extends from its western side for about three-quarters of a cable. Landing can be effected in a small sandy bay on the south-eastern side of Sunghiri island, but it is difficult of access.

Kūrmagad island is 185 feet (56m4) high and fortified all round with trees on the eastern side within the fort; it is surrounded by shoal water, which extends eastward to the entrance to Sadāshivgarh river and north-eastward to the shore. There is, however, a safe channel southward of the island, between it and Sunghiri island, with moderate depths.

Kanga islet, 69 feet (21m0) high, lies about 1¼ miles north-north-eastward of Kūrmagad island, and about three-quarters of a cable offshore. It is connected with the coast eastward by a drying reef.

Mudhulla point is situated about one mile north-north-westward of Kanga islet (*Lat. 14° 52′ N., Long. 74° 06′ E.*).

Kangiguda islet, 139 feet (42m4) high, lies about 2½ cables south-westward of Mudhulla point. A smaller islet is situated about 3 cables north-north-westward of Kangiguda islet and there is much foul ground, with rocks above and below water, between these two islets and Mudhulla point.

Charts 242, 744.

Black rock, 52 feet (15m9) high and fringed with reefs, lies about 2 miles north-westward of Kangiguda islet.

Loliem rock, which is awash at low-water springs, lies about 1¼ miles north-westward of Black rock. A rock, with a depth of less than 6 feet (1m8) over it, lies about 2¼ cables north-north-eastward of Loliem rock.

The south-western extremity of Kūrmagad island in line with Guddehalli (page 185), bearing 131°, leads south-eastward of these rocks.

Loliem point, situated about 2¾ miles north-westward of Mudhulla point, is a steep, rocky, well-wooded point, attaining an elevation of 571 feet (174m1) about half a mile inland.

About 2¼ miles eastward of Loliem point is the village of Poliem, situated on the north-eastern side of a small sandy bay.

Off-lying danger.—Buoy.—Parker rock lies about 4 miles westward of Kūrmagad island. It is marked on its north-western side by a red spherical buoy, which is liable to be washed away. There is a least depth of 2½ fathoms (4m6) over it, rock, sand and shells.

Chart 242.

Lights.—A light is exhibited, at an elevation of 210 feet (64m0), from a circular masonry tower with a white cupola, 72 feet (21m9) in height, situated on the summit of Devgad island (*Lat. 14° 49′ N., Long. 74° 03′ E.*). *See* view [14].

A light is periodically exhibited, at an elevation of 65 feet (19m8), from a white mast situated at the port office at the south-eastern end of Kārwār bay.

Storm signals.—Storm signals are displayed from the vicinity of the port office at Port Kārwār; the brief system is used. *See* page 20.

Anchorages.—During strong north-westerly winds vessels may anchor south-eastward of Karkal island, with the lighthouse on Devgad island bearing 298°, and the north-western extremity of Kūrmagad island bearing 041° and open south-eastward of East islet, about 3½ cables offshore, in a depth of 7 fathoms (12m8), mud.

During the south-west monsoon there is anchorage north-eastward

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Chart 242.

of Karkal island, with the lighthouse on Devgad island bearing 248°, and East islet bearing 186°, in a depth of 6 fathoms (11m0), mud.

Chart 242 with plan of Port Kārwār.

Vessels may obtain anchorage on the northern side of Kārwār head, at a distance of from 2 to 3 cables offshore, moored head and stern facing the west-north-westerly swell, in a depth of 4 fathoms (7m3). Vessels will be sufficiently sheltered from the south-west monsoon here to enable them to work cargo.

The inner anchorage in the port of Kārwār is with the light-mast at the south-eastern end of Kārwār bay bearing 104°, distant about 3½ cables, and about 1½ cables offshore, in a depth of 3 fathoms (5m5).

A small vessel with local knowledge may obtain a secure anchorage in Baitkal cove south-westward of the light-mast in a depth of about 1½ fathoms (2m7).

Chart 242.

Directions.—A vessel should have no difficulty in approaching and entering Kārwār bay either by day or by night, having made the lighthouse on Devgad island.

The clearing marks for the dangers eastward of Karkal island, and southward of Loliem point, are given on pages 187 and 188. Kārwār bay may be entered on either side of Sunghiri island, according to draught, and anchorage taken as requisite.

If proceeding to the inner anchorage in the port of Kārwār at night, a vessel should steer for the light at the south-eastern end of Kārwār bay, bearing 124°, and anchor in depths of from 3½ to 4½ fathoms (6m4 to 8m2), as desired.

Chart 242 with plan of Port Kārwār.

Kārwār.—On the eastern side of Kārwār bay stands the town of Kārwār, the headquarters of North Kanara district; the custom house is situated on the south-eastern entrance point of Baitkal cove.

The town is connected with the general telegraph system. Local vessels call frequently. In 1952, the population was about 20,000.

Supplies.—Meat is unprocurable, and vegetables are scarce, but poultry and fish can be obtained.

Radio.—There is a radio station at Kārwār. *See* page 24.

Charts 740, 744.

COAST.—Islands and dangers.—Lights.—The coast of the Portuguese territory of Goa extends from about latitude 14° 54′ to about latitude 15° 43′ N., and consists of sandy bays fringed with coconut trees separated by several rocky capes.

Chart 744.

Between Loliem point (*Lat. 14° 55′ N., Long. 74° 03′ E.*) and Cabo de Rama (Cape Ramas), 12½ miles north-westward, there are several bights.

The depths off this part of the coast decrease regularly towards the shore.

Rio Talpona (Talpon river) flows into the sea, about 4 miles northward of Loliem point. The town of Canacona, the capital of the district of that name, is situated on this river.

About 1½ miles north-north-westward of the entrance to Rio Talpona is the south-eastern entrance point of Baia de Canacona (Canacona bay); a reef-fringed islet lies close southward of the north-western

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Chart 744.

entrance point of this bay, about half a mile west-north-westward of the south-eastern entrance point.

Charts 740, 744.

Ponta de Paidegal (Paidegal point), about 1¾ miles north-westward of the reef-fringed islet just mentioned, is a steep projecting headland; the village of Paidegal lies on the northern side of this point.

Monte de Canacona (Canacona peak), 2,020 feet (615m7) high, lies about 4½ miles north-eastward of Ponta de Paidegal. It is the western-most summit of a range of high hills stretching eastward from the coast.

From Ponta de Paidegal the coast trends in a general north-westerly direction to Cabo de Rama; it is sandy for a distance of 1½ miles northward of Ponta de Paidegal and thence rocky to Cabo de Rama.

Ramas False bluff, about 4¼ miles north-westward of Ponta de Paidegal, is about 700 feet (213m4) high, and rises abruptly from the tableland of Cabo de Rama. From this bluff the land rises gradually eastward in a succession of four or five hills, for a distance of about 4 miles, and terminates in East peak, 1,470 feet (448m1) high; thence there is a gap, southward of which is a range of mountains known as Caı acona

Cabo de Rama projects one mile westward of Ramas False bluff; during the thick weather of the south-west monsoon no part of this coast is usually visible beyond a distance of from 4 to 5 miles. The cape is prominent, and has a fort on it.

Chart 740.

Baia de Rama lies on the northern side of Cabo de Rama between that cape and Ponta de Fortió (Moliem point), 1½ miles north-north-eastward. It is a sandy bay with a landing place on the northern side of the fort, about one mile eastward of Cabo de Rama.There are two springs, one of warm and the other of cold water, near the landing place.

Baia de Canaguinim lies between Ponta de Fortió and Ponta de Canaguinim, about 1¾ miles north-eastward.

Ponta de Betul (*Lat. 15° 09′ N., Long. 73° 57′ E.*), about one mile north-eastward of Ponta de Canaguinim, is a flat rocky point on the northern side of which is the mouth of Rio do Sal (Sal river).

Rio do Sal is only available for small vessels with local knowledge. In 1956, the entrance was about half a cable wide and had a least depth of 3 feet (0m9); there are slightly greater depths inside the entrance.

From the mouth of Rio do Sal the coast trends in a north-north-westerly direction for about 14 miles to the head of Baia de Colla, and consists of low cultivated land, with several churches on some small hills.

A white pagoda, called Chandernat temple, stands on a hill at an elevation of 900 feet (274m3), about 6¾ miles north-eastward of the entrance to Rio do Sal.

Charts 492, 740.

From Baia de Colla (Colla bay) the coast extends in a general north-westerly direction for about 5 miles to Ponta de Mormugão, the north-western extremity of Planalto de Mormugão.

Chart 492.

Ilhas de San Jorge (George), situated about 3½ miles southward of Ponta de Mormugão, consist of three islands. *See* view on chart 492.

Charts 827, 826, 748b.

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Chart 492.

Ilhéu Grande is the name given to the two southern islands, which are connected by a narrow reef of rock and shingle.

The western island of Ilhéu Grande, 247 feet (75m3) high, and conical in shape, is bold, rocky and covered with jungle towards its summit. Landing can be effected on the north-eastern side of this island.

A light is exhibited, at an elevation of 276 feet (84m1), from a three-sided metal tower, 26 feet (7m9) in height, situated on the summit of the western island of Ilhéu Grande.

The eastern island rises gradually from its western end, attaining an elevation at its eastern end of 236 feet (71m9). This summit and the northern side of this island are covered with jungle. Another summit, 168 feet (31m2) high, with a prominent tree close eastward of it, is situated about half a mile westward of the above summit. The landing place is in a small cove westward of the south-eastern end of the island.

Two rocks awash lie close eastward of the south-eastern extremity of the eastern island.

Recife de San Jorge (George), a rocky reef which dries 4 feet (1m2), lies about 2½ cables eastward of the eastern island.

Some rocks, above and below water, extend about 1½ cables southward from the southern side of the western island and from the southern side of the western part of the eastern island. Among these are two rocks, 20 feet (6m1) and 10 feet (3m0) high, situated about one cable southward and 2 cables south-south-eastward, respectively, of the southern extremity of the western island.

Sail rock (*Lat. 15° 21′ N., Long. 73° 46′ E.*), situated about 4½ cables south-south-westward of the southern extremity of the western island, is a pillar rock, 43 feet (13m1) high, which from a short distance may easily be mistaken for a sail; about three-quarters of a cable eastward of this rock is a 4¾-fathom (8m7) shoal, and about three-quarters of a cable further northward is a reef which dries 2 feet (0m6).

The coastal bank, with depths of less than 3 fathoms (5m5), extends 2 to 3 cables northward and north-eastward from the northern side of Ilhéu Grande, and depths of less than 5 fathoms (9m1) extend about 3 cables further northward and north-eastward.

Banco de San Jorge (George), lying about 8 cables west-north-westward of the western extremity of Ilhéu Grande, has a least depth of 4½ fathoms (8m2).

An obstruction was reported, in 1954, to lie about three-quarters of a mile north-north-westward of the western extremity of Ilhéu Grande.

Martha patches, a group of rocky shoals, the southern end of which lies about 6¾ cables north-westward of the northern extremity of the eastern island, extend about one mile north-north-eastward, and have depths of from 3¾ to 5 fathoms (6m9 to 9m1). They are covered by the *red* sector of Ilhéu Grande light, between the bearings of 185° and 225°.

Ilha dos Morcêgos (Ilhéu Pequena), 169 feet (51m5) high, lies about 1¼ miles north-eastward of Ilhéu Grande and about 4¾ cables offshore; it is round, flat-topped, precipitous and covered with jungle. *See* view on chart 492.

Planalto de Mormugão, 243 feet (74m1) high, the north-western extremity of which is Ponta de Mormugão, is a peninsula of table-land formation with precipitous sides, especially on the western face, and is connected with the mainland south-eastward by a neck of

Charts 740, 827, 826, 748b.

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Chart 492.

sand; the greater part of the northern and the whole of the eastern side is fortified, the fortifications terminating to the northward and westward in a fort built on the side of the hill. Midway between Ponta de Mormugão and the fort is a breakwater, eastward of which lies the harbour of Pôrto de Mormugão.

Flagstaff hill, 239 feet (72m8) high, is situated about half a mile south-eastward of Ponta de Mormugão.

The coastal bank, with depths less than 3 fathoms (5m5), extends about 2¾ cables south-westward from the western side of the northern part of this headland.

Ilhéu Cambariem (Cumbariem) (*Lat. 15° 24′ N., Long. 73° 46′ E.*) is a rock, 20 feet (6m1) high, which lies about one mile south-westward of Ponta de Mormugão.

The large amount of iron in the laterite, of which the rock is partially composed, seriously affects a magnetic compass.

Ilhéu Cambariem stands near the south-western edge of the bank, which, with depths of 5 fathoms (9m1) and less, extends south-westward from the north-western end of Planalto de Mormugão. Foul ground, with depths of 3 fathoms (5m5) and less, extends about three-quarters of a cable from its western side and about 2 cables north-eastward from its northern extremity.

Sawyers patch, situated about 4 cables northward of Ilhéu Cambariem, and about 5 cables offshore, has a depth of 3¼ fathoms (5m9).

Shoal water, with depths of less than 4 fathoms (7m3), extends eastward from Sawyers patch to the coastal bank off Planalto de Mormugão, and a shoal, with a least depth of 4¼ fathoms (7m8), lies about 1½ cables west-north-westward of Sawyers patch.

Ilhéu Cambariem, Sawyers patch together with the shoal water eastward of them are covered by the *red* sector of Ilhéu Grande light, between the bearings of 185° and 225°.

An obstruction was reported, in 1932, by the s.s. *City of Roubaix*, about 6½ cables north-westward of Ilhéu Cambariem.

Chart 744.

Anchorages.—Baia de Canacona (page 189) affords good anchorage to small vessels with local knowledge, with good shelter from strong north-westerly winds, south-eastward of the rocky islet southward of the north-western entrance point, in depths of from 3 to 4 fathoms (5m5 to 7m3), mud.

Charts 740, 744.

A small vessel with local knowledge can obtain anchorage, with shelter from strong north-westerly winds, close off the southern side of the fort on Cabo de Rama (page 190), in depths of from 5 to 6 fathoms (9m1 to 11m0); the coast here is steep-to.

Chart 740.

Anchorage can be obtained in Baia de Rama and Baia de Canaguinim about half a mile north-north-eastward of Cabo de Rama and Ponta de Fortió, respectively, in depths of 6¼ and 5 fathoms (11m4 and 9m1), respectively, mud.

Baia de Colla (page 190) affords sheltered anchorage during north-westerly winds to moderate-sized vessels in depths of about 4 fathoms (7m3).

Chart 492.

A large vessel can obtain anchorage southward of Ilhéu Grande,

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Chart 492.

with shelter from north-westerly winds, about 3¾ cables south-westward of its south-eastern extremity (*Lat. 15° 21′ N., Long. 73° 47′ E.*), in depths of 10 fathoms (18m3), mud.

A small vessel can anchor about 1¼ cables east-south-eastward of the same point in charted depths of from 9 to 10 fathoms (16m5 to 18m3).

BAIA DE MORMUGÃO.—The entrance to Baia de Mormugão, which lies between Planalto de Mormugão and Ponta do Cabo (Cabo), about 3 miles northward, is encumbered with shoals. *See* view on chart.

Rio Zuari flows into the head of Baia de Mormugão; it is only navigable by small craft with local knowledge; the bar at the entrance has a least depth of 7 feet (2m1), but there are depths of 3 fathoms (5m5) within it.

Aspect.—Planalto de Mormugão, the southern entrance point of Baia de Mormugão, is described on page 191.

The southern side of Baia de Mormugão is mostly bold and rocky, rising inland to tableland, from 100 to 150 feet (30m5 to 45m7) in elevation.

About 2 miles east-south-eastward of Ponta de Mormugão, at the head of the bay eastward of Planalto de Mormugão, is the fishing village of Mormugão.

Ponto do Cabo, the northern entrance point of the bay and the western extremity of Ilha de Goa or Tissuadi, is a prominent headland, 198 feet (60m3) high, covered with jungle; on it stands a large building used as the summer palace of the Governor-General.

Between Ponta do Cabo and Ponta da Nazare, about 3¾ miles east-south-eastward, the northern side of Baia de Mormugão is alternately sandy and rocky; the land within attains an elevation of about 100 feet (30m5), and is covered with jungle.

Pilots.—There are no regular pilots, but the railway company will send a person qualified to give advice, if the usual pilot signal is hoisted.

There is a Captain of the Port, but the berthing of vessels is carried out by an official of the railway company. The berthing officer will not berth ships between sunset and sunrise.

Quarantine.—The appropriate quarantine signal given in the International Code of Signals must be hoisted by all vessels entering the port, and kept flying until pratique has been granted.

Signal station.—There is a signal station near the north-western extremity of Planalto de Mormugão.

Chart 740.

Depths.—Entrance.—Depths less than are shown on chart 740 were reported, in 1916, to exist about 3 miles westward of the entrance to Baia de Mormugão.

Chart 492.

The principal channel into Baia de Mormugão lies between Recife de Mormugão (Roca Mormugão), about 5 cables northward of Ponta de Mormugão (*Lat. 15° 25′ N., Long. 73° 47′ E.*), and the northern extremity of Pôrto de Mormugão breakwater, about 5½ cables north-eastward of the same point. The depths in the entrance to this channel are about 5 fathoms (9m1), decreasing to 4½ fathoms (8m2) northward of the breakwater, and from thence decreasing gradually to the bar of Rio Zuari.

Caution.—It was reported, in 1932, that the depths eastward of a

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Chart 492.

line drawn in an 045° direction from the head of the breakwater had decreased. Vessels must not proceed eastward of this line without local knowledge.

Lights.—A light is exhibited, at an elevation of 46 feet (14m0), from a white concrete column, 38 feet (11m6) in height, situated on the northern extremity of the breakwater.

A light, not visible from seaward, is exhibited at an elevation of 9 feet (2m7) from a concrete structure, situated on the eastern extremity of the mole, about 1½ cables east-south-eastward of the breakwater light.

Leading lights are exhibited:—the front light, at an elevation of 42 feet (12m8), from a white circular tower, 34 feet (10m4) in height, situated on Ponta de Chicalim, about 2¾ miles eastward of the head of the breakwater; the rear light, at an elevation of 184 feet (56m1), from a white circular tower, 35 feet (10m7) in height, situated on Ilha de San Jacinto, about 1½ miles east-south-eastward of the front light-tower. The rear light-tower is reported to be difficult to distinguish from the surrounding buildings. These lights in line, bearing 102°, lead towards the entrance clear of all dangers; they are only visible on the leading line.

Dangers.—Light-buoy.—Recife de Mormugão, the southernmost danger in the entrance to Baia de Mormugão, has a least depth of 3¾ fathoms (6m9) over it; a red can light-buoy, exhibiting a *red flashing* light *every seven seconds*, is moored about 1½ cables south-eastward of the shoalest part.

Amee shoals, close northward of Recife de Mormugão, lie in the centre of the entrance to Baia de Mormugão; they are a group of shoals with depths of less than 3 fathoms (5m5) and a least depth of less than 6 feet (1m8). The easternmost of these shoals, with a depth of 2½ fathoms (4m6), rock, lies about 7 cables northward of Pôrto de Mormugão Breakwater light-structure. In 1960, an obstruction, with a depth of 3½ fathoms (6m4), was reported to lie about 4¼ cables north-north-westward of the same light-structure.

Recife Sanchi (Sunchi reefs), situated about 9 cables south-south-westward of Ponta do Cabo, and midway between it and Amee shoals, are a group of rocky patches, several of which dry. Marivel patches, lying about 7½ cables southward of Ponta do Cabo, and about midway between Recife Sanchi and the foul ground extending south-westward from Ponto do Cabo, are awash in places.

In the south-west monsoon the sea always breaks heavily over all these dangers, which are covered by the *red* sector of Porto de Mormugão Breakwater light, between the bearings of 112° and 197°, and by the *red* sector of Ilhéu Grande light (page 191), between the bearings of 185° and 225°.

Foul ground and shoal water, with depths of less than 3 fathoms (5m5), extend about 4½ cables west-north-westward and about 6 cables west-south-westward from Ponta do Cabo. Roca de Cabo, the west-south-western extremity of the shoal water, has a least depth of 1¼ fathoms (2m3). Recife de Cabo, lying midway between Roca de Cabo and Ponta do Cabo, dries.

Outer patches, with a depth of less than 6 feet (1m8), rock, lie about 8 cables westward of Ponta do Cabo (*Lat. 15° 28′ N., Long. 73° 47′ E.*). Several patches, with depths of from 1¼ to 3¼ fathoms (2m3 to 5m9)

Charts 740, 827, 826, 748b.

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Chart 492.

over them, lie between Outer patches and the foul area mentioned above.

Ilhéu Cambariem (page 192) in line with the eastern cliff of Ilhéu Grande (page 191), bearing 169°, leads westward of all the dangers in the entrance to Baia de Mormugão.

Coast.—Dangers.—Between Ponta do Cabo and Ilhéu de Cankarso (Cankarso island), about 1¼ miles south-eastward, the northern side of Baia de Mormugão is fronted by a continuation of the foul ground and shoals, referred to above, to a distance of about half a mile offshore. Pedras de Albuquerque, awash, and Searle patch, with a depth of 1¾ fathoms (3m2) over it, lie on the south-western edge of this foul area about 3½ cables south-westward of Ponta do Cabo and 3 cables south-westward of Ilhéu de Cankarso, respectively. Pascoe rocks, awash, lie midway between the island and Searle patch.

Ilhéu de Cankarso, 42 feet (12m8) high and rocky, is connected to the headland north-westward by a drying reef.

Between Ilhéu de Cankarso and Ponta de Cacarā, 2¼ miles eastward, the coastal reef, which dries, extends from the northern side of the bay in places to a distance of about 1½ cables; the ruins of a large cross stand on Ponta de Orxel (Orxel point), which lies about three-quarters of a mile east-north-eastward of Ilhéu de Cankarso.

Baia Dona Paula lies immediately north-eastward of Ilhéu de Cankarso. A landing slip and the small fishing village of Dona Paula are situated in the bay.

In the sandy cove next eastward of Baia Dona Paula there is a landing place.

Eastward of Planalto de Mormugão the southern side of Baia de Mormugão is much indented with bays. Ponta Alparqueiros lies about 2 miles eastward of Ponta de Mormugão; it is the north-western extremity of a peninsula, which rises to an elevation of 139 feet (42m4).

Ponta de Chicalim lies about 1½ miles eastward of Ponta Alparqueiros. The coastal bank, with depths of less than 6 feet (1m8), extends about half a mile offshore between Ponta de Chicalim and the entrance to Rio Zuari (*Lat. 15° 25′ N., Long. 73° 54′ E.*).

Ilha de San Jacinto, lying on the coastal bank about 1¼ miles eastward of Ponta de Chicalim and about 1½ cables offshore, is flat-topped, precipitous and covered with dense jungle; on its southern side are some fortifications and the remains of a church. Ilha de San Jacinto is connected with the coast southward by a mudflat, which dries.

Ilhéu Vareg also lies on the coastal bank about midway between Ponta de Chicalim and Ilha de San Jacinto.

Port limits.—*Pôrto de Mormugão.*—Pôrto de Mormugão comprises all waters within a line joining the following points as indicated on the chart:—Ponta de Chicalim, Amee shoals, Ponta de Mormugão, the south-western extremity of Planalto de Mormugão, Ilha dos Morcêgos and Ponta Bimbili (Bimbay point).

Pôrto Dona Paula.—Pôrto Dona Paula comprises all waters northward and eastward of a line joining Ponta de Nazare, Recife Sanchi and Ponta do Cabo. The southern limit of the port is indicated on the chart.

Prohibited anchorage.—That part of Baia de Mormugão which lies between the northern limit of Pôrto de Mormugão and the southern limit of Pôrto Dona Paula is termed Neutral ground; vessels are prohibited from anchoring here.

Charts 740, 827, 826, 784b.

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Chart 492.

Pôrto de Mormugão.—Berths.—Buoys.—Depths.—Pôrto de Mormugão (*Lat. 15° 25′ N., Long. 73° 48′ E.*), situated on the northern side of Planalto de Mormugão, is open all the year round; it is formed by a breakwater, which extends 1,700 feet (518m2) north-north-eastward from the shore about 4 cables eastward of Ponta de Mormugão. About 180 feet (54m9) within the outer end of the breakwater, a mole extends in an easterly direction for about 900 feet (274m3). There are landing steps at the root of the breakwater.

The depth in the approach, northward of the breakwater and mole, is 4½ fathoms (8m2). The north-eastern part of the harbour has depths of from 3¼ to 4½ fathoms (5m9 to 8m2), and the south-western part from 3¼ to 5 fathoms (5m9 to 9m1); the bottom in the latter part is reported to be very soft mud, and dredging is constantly employed to prevent silting up.

The eastern end of the mole should not be approached too closely.

A quay, 2,790 feet (850m4) long, extends eastward from the root of the breakwater; it has six berths alongside. Berths Nos. 1 and 2 are primarily intended for coastal vessels of up to 22 feet (6m7) draught. Berths Nos. 3, 4 and 5 can accommodate vessels of up to 27 feet (8m2) draught, and berth No. 6 up to 28 feet (8m5). However, during the south-west monsoon (mid-May to mid-September) the maximum safe draught for vessels using the port is 26 feet (7m9) though the port authority may authorise 26½ feet (8m1) should the weather permit.

An iron pier, 250 feet (76m2) in length and with a depth of 12 feet (3m7) alongside, is situated about 2¼ cables south-south-eastward of the south-eastern end of the quay.

There are a number of mooring buoys in the harbour for the convenience of vessels berthed alongside.

Charts 492, 740.

Anchorages.—During the fine season large vessels can obtain anchorage about 3¼ miles north-westward of Ponta de Mormugão (*Lat. 15° 25′ N., Long. 73° 47′ E.*), in depths of 9 fathoms (16m5), mud. *Chart 492.*

Anchorage is available for small vessels, sheltered from the south-westward, about 4 cables south-eastward of the head of the mole at Pôrto de Mormugão in a depth of 3 fathoms (5m5), mud; also in the bay on the eastern side of Planalto de Mormugão in depths of from 1½ to 2½ fathoms (2m7 to 4m6), mud.

Baia Dona Paula, north-eastward of Ilhéu de Cankarso, affords good shelter from north-westerly winds to small vessels with local knowledge.

Charts 492, 740.

Directions.—A vessel bound for Baia de Mormugão from southward should pass about 1½ miles westward of Ilhéu Grande, and about one mile westward of Ilhéu Cambariem, taking care to avoid the obstruction about 6½ cables north-westward of Ilhéu Cambariem (*see* page 192).

When the northern end of Pôrto de Mormugão breakwater bears 090° course should be shaped to pass between the light-buoy marking Recife de Mormugão and the breakwater, and from thence as requisite to enter the harbour. *See* caution on page 193.

A vessel approaching from northward should steer to pass about one mile westward of Morro da Agoada (page 197), which lies about 1¾

Charts 740, 827, 826, 748b.

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Charts 492, 740.

miles north-north-westward of Ponta do Cabo; thence she should steer with Ilhéu Cambariem in line with the eastern cliff of Ilhéu Grande, bearing 169°, which leads westward of all the dangers in the entrance to Baia de Mormugão. When the lighthouses on Ponta de Chicalim and Ilha de San Jacinto are in line, bearing 102°, she should alter course for them and, keeping them in line, steer into Baia de Mormugão (*Lat. 15° 26′ N., Long. 73° 49′ E.*).

During thick weather a vessel should not, when between Ilhas de San Jorge and Morro da Agoada, proceed into depths of less than 10 fathoms (18m3).

At night, a vessel should enter Baia de Mormugão with the leading lights on Ponta de Chicalim and Ilha de San Jacinto in line, bearing 102°, and pass at a suitable distance southward of the light-buoy marking Recife de Mormugão and northward of the breakwater and mole, whence the harbour may be entered.

Chart 492.

Port facilities.—No bunkers are available.

Water can be supplied from hydrants on the quay or from a water barge with a capacity of 100 tons.

Bread and meat are scarce and vegetables are unobtainable.

Small repairs can be undertaken.

Fourteen travelling cranes are available at Nos. 1 to 5 berths on the quay; the largest has a capacity of 30 tons. No. 6 berth is an ore loading berth with facilities for the mechanical handling of ore at a rate of 650 tons an hour.

Storm signals.—Storm signals are displayed from the head of Pôrto de Mormugão breakwater; the extended system is used. *See* page 20.

Winds.—From about the middle of February to the end of March there are occasionally strong north-easterly winds, generally lasting from three to seven days, decreasing in strength at sunset, and increasing again at sunrise; these winds cause a heavy swell in Baia de Mormugão.

Trade.—Shipping.—The principal exports are manganese and iron ores and cashew nuts. The main imports are rice, sugar, tinned foods, hardware, motor vehicles and machinery.

In 1958, 277 vessels used the port.

Communications.—Local vessels call regularly. The harbour is connected with the Indian railway system but it is reported that no trains have run since 1955.

There is an airfield 3 miles from the harbour from which services are maintained with Karāchi and Lisbon.

Radio.—There is a radio station on Ilha de Goa. *See* page 24.

ENSEADA DA AGOADA.—Aspect.—Signal station.—Enseada da Agoada, the entrance to which lies between Ponta do Cabo (*Lat. 15° 28′ N., Long. 73° 47′ E.*) and Morro da Agoada, about 1¾ miles north-north-westward, affords good anchorage to moderate-sized vessels during the north-east monsoon.

Morro da Agoada is a bold bluff headland, 260 feet (79m2) high, which from seaward appears to have a flat summit. Where it is connected with the mainland northward it is low, sandy and covered with coconut groves; here at all times there is a heavy surf on the

Charts 827, 826, 748b.

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Chart 492.

beach. The whole of the northern side of the hill is fortified, also a portion of the southern side; the parts not fortified are inaccessible. *See* view on chart.

A fort, within which there is a signal station with a flagstaff, stands on the southern side of Morro da Agoada; outside the fort there are several houses and the saluting battery.

Morro da Candolim (Candolim hill), 239 feet (72m8) high, about 2 miles northward of the fort on Morro da Agoada, is easily identified by two conspicuous banyan trees.

The chapel of San Lorenzo, standing on a hill about half a mile east-north-eastward of the fort on Morro da Agoada, is a conspicuous landmark.

Morro da Reis, about 9 cables north-eastward of the chapel of San Lorenzo, has a bare summit, 169 feet (51m5) high, but the foot and slopes of the hill are covered with coconut trees and jungle.

Rio de Sinquerim flows into Enseada de Agoada on the north-eastern side of Morro da Agoada; this river is about 5 miles long, tidal throughout and navigable by boats at high water.

From Ponta do Cabo the south-eastern shore of Enseada da Agoada trends about three-quarters of a mile east-south-eastward to the head of Baia de Caranzalem, and is high and rocky. Thence it trends about 1½ miles north-north-eastward to Forte Gaspar Dias; this stretch of the shore is low and sandy, with extensive coconut groves. Forte Gaspar Dias is situated on the south-eastern side of the entrance to Rio de Mandāvi.

Chart 740.

Caution.—Depths less than shown on chart 740 were reported, in 1916, to exist about 3 miles westward of the entrance to Enseada da Agoada (*Lat. 15° 29′ N., Long. 73° 47′ E.*).

Chart 492.

Dangers.—The dangers extending westward from Ponta do Cabo, on the southern side of the entrance to Enseada da Agoada, are described on page 194; the slaughter-house, about 7¼ cables east-north-eastward of Forte Gaspar Dias, in line with Pilots Brow, about 5 cables east-north-eastward, bearing 061°, leads north-eastward of these dangers.

The coastal bank, which fringes Morro da Agoada, extends about three-quarters of a cable westward from its western side, and is steep-to.

A rock, which dries, lies about half a cable eastward of Ponta Mama, the southern entrance point of Rio de Sinquerim.

Between Ponta Mama and Forte dos Reis Magos, 1¼ miles eastward, the northern side of Enseada da Agoada is fringed with rocks, which extend about three-quarters of a cable offshore.

Lights.—A light is exhibited at an elevation of 275 feet (83m8) from a white circular tower, 53 feet (16m2) in height, situated on the fort on the southern side of Morro da Agoada.

A light is exhibited at an elevation of 89 feet (27m1) from a white tower, 34 feet (10m4) in height, situated about one cable southward of the lighthouse just described.

Chart 740.

Anchorages.—During the fine season large vessels may anchor about 2½ miles westward of Morro da Agoada, with Ponta de Mormugão bearing 140° and Agoada lighthouse 079°, in a depth of 9 fathoms (16m5), mud.

Charts 827, 826, 748b.

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Chart 492.

A moderate-sized vessel can obtain anchorage southward of Morro da Agoada, with Agoada lighthouse bearing 011°, about three-quarters of a mile from the northern side of the bay, in depths of 4½ fathoms (8m2), mud.

A small vessel may anchor about three-quarters of a mile northward of Ponta do Cabo, with Agoada lighthouse (*Lat. 15° 29′ N., Long. 73° 46′ E.*) bearing 315°, in depths of 3 fathoms (5m5), mud.

Tidal streams.—The ebb stream sets strongly out of Rio de Mandāvi, but at the anchorages off Agoada lighthouse the rate of this stream is only one knot; the flood stream is scarcely perceptible in Enseada da Agoada.

Directions.—A vessel coming from southward must take care to avoid the dangers in the entrance to Baia de Mormugão, and the foul ground extending westward from Ponta do Cabo; the clearing marks leading westward and north-eastward of these dangers are given on page 195 and above, respectively.

If coming from northward a vessel should give the western extremity of Morro da Agoada a berth of about half a mile.

Enseada da Agoada is free from dangers, but with strong westerly winds there is a heavy swell.

Storm signals.—Storm signals are displayed from the signal station on Morro da Agoada; the brief system is used. *See* page 20.

Life-saving.—A lifeboat is stationed at the mouth of Rio de Sinquerim.

Rio de Mandāvi.—Rio de Mandāvi, which is the most important river in the Portuguese territory of Goa, flows into the head of Enseada da Agoada. Mapusa and Naroa rivers flow into its northern side, about 2 and 3½ miles, respectively, from its mouth.

Mapusa, Mandāvi and Naroa rivers form Chorao island, and Naroa and Mandāvi rivers Divar island. These islands are low-lying and principally artificial, with a frontage of mangrove swamps; the southern sides of these islands form part of the northern bank of Rio de Mandāvi.

Pilots.—Pilotage is compulsory for merchant vessels. A Government pilot will board from the pilot station on Morro da Agoada.

Bar.—The bar of Rio de Mandāvi, which is subject to change, has, during the fine season, a depth of about 15 feet (4m6); in the south-west monsoon heavy breakers extend across the entrance, and the river is inaccessible.

The entrance to the river, abreast Forte Gaspar Dias, is about 7 cables wide, though the channel is contracted to less than one cable by sandbanks.

Channel.—Dangers.—Buoyage.—Banco de Reis (Reis sand) lies in the fairway of the river. Its southern extremity is situated about 7 cables north-north-eastward of Forte Gaspar Dias, and about 2½ cables east-south-eastward of Forte dos Reis Magos, which stands on the northern side of the entrance. This shoal dries near its north-western edge. It is marked by a black barrel buoy at both its southern and north-eastern ends.

The channel is marked by red buoys on the northern and western sides, and by black buoys on its eastern and southern sides.

Lights.—A light is exhibited, at an elevation of 31 feet (9m4), from a white stone beacon with a red band, surmounted by a diamond top-

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Chart 492.

mark, situated at Tejo, on the south-eastern side of Rio de Mandāvi, about 2½ cables north-north-eastward of Forte Gaspar Dias.

A light is exhibited, at an elevation of 46 feet (14m0), from a white tower, situated on the north-western side of Rio de Mandāvi, about 2¾ cables north-north-eastward of Forte dos Reis Magos.

Leading lights are exhibited:—the front light, at an elevation of 39 feet (11m9), from a pyramidal iron framework structure with white bands, 36 feet (11m0) in height, at Campal (*Lat. 15° 30′ N., Long. 73° 49′ E.*), about 9½ cables north-eastward of Forte Gaspar Dias; and the rear light, at an elevation of 102 feet (31m1), from a white framework structure on a dwelling, 36 feet (11m0) in height, situated at Malim, about one mile north-eastward of the front light-structure. These lights in line, bearing 052°, lead across the bar.

All the above lights are extinguished during the strength of the south-west monsoon.

Submarine cable.—A submarine cable crosses Rio de Mandāvi, in the vicinity of Malim; the landing places of the cable are marked by two posts on each bank of the river, painted black and white in stripes, and surmounted by white boards. Vessels are prohibited from anchoring in the vicinity of this cable.

Charts 492, 740.

Goa.—Goa is properly the name of three cities which represent successive stages in the history of India; the earliest of the three was an ancient Hindu city; the second, now known as Old Goa, was the first capital of the Portuguese; and the third, Panjim (Pangim) is the present seat of the Portuguese administration and the ecclesiastical metropolis of Roman Catholic India.

New Goa includes Panjim, which is situated on the southern side of Rio de Mandāvi, about 1¼ miles north-eastward of Forte Gaspar Dias, Ribandar, about 1¾ miles eastward of Panjim, and also the old city of Goa, about 2½ miles eastward of Ribandar.

Panjim was, in 1843, formally decreed the capital of Portuguese India. It is a well-built city, with the sea wall and quay on the river bank, alongside which boats can lie afloat at all times of the tide. Panjim suffers from a great scarcity of water.

The Governor General's palace stands on the river bank, and near it are most of the public buildings. The church of Nossa Senhora de Conceiçao is situated on the north-western slope of Panjim (Pangim) hill and is conspicuous; part of the town is built on the northern spur of this hill, which has a signal station and flagstaff close to the northern end. The most populous quarter of Panjim, called Fountainhas, is situated on the eastern side of the hill.

Ribandar is a residential district; it is connected with Panjim by a causeway.

Old Goa was built by the Mohammadans in 1479; it was conquered by Albuquerque in 1510, and became the Portuguese capital of Asia; it is now in ruins, and is for the most part overgrown with trees.

The river bank between Ribandar (*Lat. 15° 30′ N., Long. 73° 52′ N.*) and Old Goa is fringed with coconut trees, and the remains of old buildings and churches are still to be traced along the banks.

Communications.—There is frequent communication by sea with other coastal ports; the town is connected with the general telegraph system.

Charts 827, 826, 748b.

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Charts 492, 740.

Trade.—The principal exports are cotton, salt and seeds, and the principal imports piece-goods and kerosene.

Chart 740.

COAST.—Dangers.—Anchorage.—From Morro da Agoada to Ponta de Baga (Baga point), about 4 miles north-north-westward, the coast is sandy and fringed with coconut trees. Inland the two conspicuous banyan trees on Morro de Candolim, described on page 198, form a prominent landmark.

Between Ponta de Baga and Fortaleza de Chapora (Chapora fort), which stands on a high bluff point on the southern side of the entrance to Rio Tilāri (Chapora river), about three miles northward, the coast consists of indented sandy beaches, with a projecting point midway between Ponta de Baga and Fortaleza de Chapora.

Fortaleza de Chapora can easily be identified by its black walls.

Rio Tilāri flows into the sea northward of Forte de Chapora; the bar at the entrance can only be crossed by small vessels with local knowledge. The land on the southern side of the entrance is hilly, but on the northern side it is sandy, with coconut trees.

The entrance to Rio Terekhol (Tirakul river) lies about 7 miles north-north-westward of Fortaleza de Chapora. This river has its source in the Western Ghāts and flows from thence in a south-westerly direction, forming the northern boundary of the territory of Goa, until it nears the river mouth. The bar has depths of from 8 to 9 feet (2^{m}4 to 2^{m}7) in its narrow entrance, but it is subject to change.

Forte de Terekhol (Tirakul fort) stands on the brow of a hill on the northern side of the river entrance.

About 1½ miles westward of the entrance to Rio Terekhol there is a sharp pinnacle awash, known as Havelock rock; another rock, also awash, lies about 4 cables north-eastward of it.

Anchorage can be obtained west-south-westward of Forte de Terekhol (*Lat. 15° 43′ N., Long. 73° 41′ E.*), about 1¼ miles offshore, in a depth of 5 fathoms (9^{m}1), mud.

Charts 827, 826, 748b.

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CHAPTER VI

KONKAN COAST.—RIO TEREKHOL TO BOMBAY HARBOUR

Chart 826.

GENERAL REMARKS.—The coast between the entrance to Rio Terekhol (*Lat. 15° 43′ N., Long. 73° 41′ E.*) and Damān, about 290 miles northward, is known as the Konkan coast (page 8). Its general features consist of small sandy bays and bold rocky capes, and there is much tableland along its southern part.

The Western Ghāts, which form the eastern boundary of the Konkan coast, are from 3,000 to 4,700 feet (914^{m}4 to 1,432^{m}6) high. They stand like a wall, parallel to the coast, at an average distance of 30 miles.

Charts 902, 740.

COAST.—Dangers.—From the entrance to Rio Terekhol the coast trends in a north-westerly direction for about 2¼ miles to Redi (Rairi) point, and from thence in a north-north-westerly direction for 6¾ miles to Vengurla point.

Chart 740.

Havelock rock, and the rock east-north-eastward of it, lying about 1¼ miles westward of the northern entrance point of Rio Terekhol, are described on page 201.

Redi point is a flat rocky projection, the western extremity of which is 50 feet (15^{m}2) high.

Foul ground and shoal water extend about three-quarters of a mile south-south-westward and about half a mile westward from this point; at the southern edge of this foul area is Redi (Rairi) rock, which is 36 feet (11^{m}0) high and steep-to.

Caution.—A vessel should not proceed into depths of less than 10 fathoms (18^{m}3) when in the vicinity of this point.

Coast.—About half a mile east-north-eastward of Redi point is the entrance to a creek, which is only available for boats; on the southern side, just within its entrance, stands Redi (Rairi) fort, which has an elevation of 113 feet (34^{m}4). The village of Redi (Rari) is situated about half a mile south-eastward of the fort.

Machlimar point, 276 feet (84^{m}1) high, lies about 3¾ miles northward of Redi point. The mouth of Talavda river (Machlimar creek) is situated about one mile south-south-eastward of Machlimar point.

Charts 902, plan of Vengurla; 740.

Vengurla point, 237 feet (72^{m}2) high, lies about 3 miles north-north-westward of Machlimar point.

Wagh-ghiri, also known as Tiger hill, 1,053 feet (321^{m}0) high, is a prominent wooded summit, situated about 5 miles east-north-eastward of Vengurla point.

Charts 827, 748b.

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Chart 902, plan of Vengurla.

Vengurla roads.—Light.—Signal station.—Storm signals.—Dangers.—Buoys.—Vengurla roads lie southward and south-westward of Vengurla point.

A light is periodically exhibited, at an elevation of 275 feet (83m8), from a mast on a white house, 41 feet (12m5) in height, situated on Vengurla point. *See* view on chart 902; there is a second white house, similar to and close to the lighthouse.

There is a signal station on the point with a mast from which storm signals are displayed; the brief system is used. *See* page 20.

South rock, situated about 3¾ cables southward of Vengurla point, has a depth of 10 feet (3m0) over it. Two shoals, with depths of 15 and 17 feet (4m6 and 5m2), lie about three-quarters of a cable south-westward and half a cable westward, respectively, of South rock. A black conical buoy, which is withdrawn during the south-west monsoon, is moored about half a cable north-westward of South rock to mark these dangers.

A rocky shoal, with a depth of 14 feet (4m3) over it, lies about 5 cables south-eastward of Vengurla point and about 3½ cables offshore.

East rock, about 3¼ cables south-eastward of Vengurla point, has a depth of 6 feet (1m8) over it; it is marked by a black can buoy, which is withdrawn during the south-west monsoon, moored about a quarter of a cable westward of it.

A shoal, with a depth of 15 feet (4m6), is situated about 1¾ cables south-south-eastward of Vengurla point (*Lat. 15° 51′ N., Long. 73° 37′ E.*).

South West Point rock, lying about 2½ cables westward of Vengurla point, has a least depth of 4 feet (1m2) over it; it is marked by a black can buoy, which is withdrawn during the south-west monsoon, moored about half a cable south-south-westward of it.

Chart 902.

Tidal streams.—Between Vengurla roads and the north-western entrance to Karil Kachal channel (page 205), about 10 miles west-north-westward, the tidal streams set in a northerly direction with the flood tide, and in a southerly direction with the ebb, at a rate of about one knot during springs.

Chart 902, plan of Vengurla.

Anchorages.—A large vessel can obtain anchorage in Vengurla roads with the flagstaff on Vengurla point bearing 036°, distant about three-quarters of a mile, in depths of 5½ fathoms (10m1), or closer inshore with the flagstaff on the same bearing, and the landing quay which is situated on the eastern side of the point, about half a cable from its southern extremity, in line with the custom house, about 4¼ cables east-north-eastward, bearing 057°, in depths of 32 feet (9m8). *See* view on chart 902.

A small vessel with local knowledge may obtain anchorage, with shelter from north-westerly winds, in the bight on the eastern side of Vengurla point, in depths of from 2 to 3 fathoms (3m7 to 5m5).

Vengurla.—Supplies.—Communications.—The town of Vengurla lies about three-quarters of a mile north-eastward of Vengurla point. In 1951, it had a population of 22,778.

Fresh water, fruit and vegetables are available in moderate quantities.

Local vessels call here regularly, and a large number of native craft also visit the port.

Charts 2736, 827, 826, 748b.

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Chart 902, plan of Vengurla.

There is a crane on the landing quay on the eastern side of Vengurla point.

Chart 902.

Coast.—Dangers.—Buoys.—From Vengurla point the coast trends north-westward for about 8 miles to a salient point, 171 feet (52^{m}1) high, on which stand the ruins of Niuti (Nuti) fort; it forms a bight, with several rocky capes and sandy bays, intersected by a number of creeks, the largest and southernmost of which is Dabholi creek, situated about three-quarters of a mile north-north-westward of Vengurla point.

From the point on which Niuti fort stands the coast trends north-north-westward for about 7 miles to the southern entrance point of Malvan bay, and is sandy. The fortified island of Sindhudurg (Sindhudrug) Janjira lies close south-westward of this point.

Within the point on which Niuti fort stands the land rises to an elevation of about 500 feet (152^{m}4); about 2 miles northward of the fort there is a prominent hill, 520 feet (158^{m}5) high.

About 1½ miles north-north-westward of Niuti fort is the entrance to Karli creek, which can only be used by boats.

South West Point rock, about 2½ cables westward of Vengurla point, is described on page 203.

A shoal, with a least depth of 4 fathoms (7^{m}3), is situated about 2½ miles north-westward of Vengurla point and about 7 cables offshore.

Bhubra (Bubra) rock, situated about 3½ cables south-westward of Niuti fort (*Lat. 15° 56′ N., Long. 73° 31′ E.*), is awash; it is marked on its south-western side during the fine season by a black buoy, the position of which is not reliable.

Karil rock, the northernmost of Vengurla rocks or Burnt islands (*see* page 205), is a peaked islet, 45 feet (13^{m}7) high; about 3 cables eastward of this islet there is a rock awash. Some rocks above water extend about three-quarters of a cable north-westward from Karil rock; they are steep-to on their northern side.

For a distance of about 4 miles north-north-westward of the point on which Niuti fort stands, foul ground extends about 2¼ miles offshore. Chaldea rock, at the southern edge of this foul area, about 1¼ miles north-north-eastward of Karil rock, is awash; a black conical buoy, which is withdrawn during the south-west monsoon, is moored about 2 cables south-westward of it. Some detached shoals, with a least depth of 4 fathoms (7^{m}3), lie between about 1¾ and 4½ cables south-eastward and southward of Chaldea rock. The westernmost danger of this foul area is a 3½-fathom (6^{m}4) shoal, lying about 2¾ miles north-north-westward of Karil rock and about 2¼ miles offshore.

Square rock, 40 feet (12^{m}2) high, lies about 3¼ miles northward of Karil rock and about 1¾ miles offshore; it is the western visible danger in this foul area and a useful mark for avoiding these dangers.

About 1½ and 1½ miles north-north-eastward of Square rock are two shoals, with depths of 4½ and 4¾ fathoms (8^{m}2 and 8^{m}7), respectively; they lie about 1½ miles offshore.

Mandel rock, about 2 miles northward of Square rock and about 9½ cables southward of Sindhudurg Janjira, is 18 feet (5^{m}5) high, and lies at the western edge of a group of shoals, some of which are awash; these shoals extend about 6½ cables in an east-north-easterly, easterly and south-easterly direction from Mandel rock.

Charts 740, 2736, 827, 826, 748b.

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Chart 902.

The depths are irregular, with a least depth of 4¾ fathoms (8m7), for about one mile westward of Mandel rock.

Malvan rock, situated about 1½ miles west-north-westward of Mandel rock, and about 1½ miles offshore, has a depth of 1¼ fathoms (2m3) over it; it is marked on its western side by a spherical buoy, painted black, red and white in horizontal bands, which is withdrawn during the south-west monsoon; a 4¼-fathom (7m8) shoal lies about 1½ cables east-south-eastward of Malvan rock, and a 5-fathom (9m1) shoal about 2½ cables farther east-south-eastward.

Square rock in line with the point on which Niuti fort stands, bearing 133°, leads about one mile south-westward of Malvan rock.

Off-lying islets and dangers.—Light.—Vengurla rocks or Burnt islands, consisting of a group of islets and above and below water rocks, extend about 3 miles northward from Tapti rock, the southernmost danger, which lies about 9¼ miles west-north-westward of Vengurla point (*Lat. 15° 51′ N., Long. 73° 37′ E.*). For radar ranges *see* Appendix III on page 346.

Tapti rock has two heads with depths of less than 6 feet (1m8) over them; it is steep-to on its southern side.

The south-westernmost islet and danger of the group lies about a quarter of a mile north-north-westward of Tapti rock; it is 80 feet (24m4) high and has a disused lighthouse near its south-eastern extremity. Another islet, 25 feet (7m6) high with an above-water rock close westward of it, lies about one cable east-south-eastward of the south-westernmost islet.

A light is exhibited, at an elevation of 162 feet (49m4), from an iron tower, 70 feet (21m3) in height, situated on the north-western extremity of an unnamed islet lying about 3 cables north-eastward of Tapti rock. This light is obscured on certain bearings by the islets in the vicinity.

Vengurla rock, 135 feet (41m1) high and the highest islet of the group, is situated about three-quarters of a mile north-north-eastward of Tapti rock.

Between Vengurla rock and Karil rock, the northernmost islet of the group (described on page 204), about 2¼ miles northward, there is dangerous foul ground, with numerous above-water and sunken rocks.

Caution.—Between the southern extremity of Vengurla rocks and Malvan rock, excepting in Karil Kachal channel (*see* below) between Karil and Chaldea rocks, the bottom is sand and rock, and there are sudden overfalls. No vessel should proceed into depths of less than 10 fathoms (18m3) in this neighbourhood.

When passing Malvan rock at night Vengurla Rocks light should not be brought to bear more than 158°, nor should a vessel approaching this rock proceed into a depth of less than 15 fathoms (27m4).

Karil Kachal channel.—Directions.—Karil Kachal channel, leading from seaward between Karil and Chaldea rocks, has moderate depths.

Charts 902, 740.

A vessel coming from the northward, and intending to proceed through this channel, should approach with Wagh-ghiri mountain 5 miles east-north-eastward of Vengurla point, bearing about 105° and well open southward of the point on which Niuti fort (*Lat. 15° 56′*

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Charts 902, 740.

N., Long. 73° 31′ E.) stands; when Niuti fort bears 093°, she should steer through the fairway on that bearing, which leads northward of Karil rock (*see* view A on chart 902).

When Vengurla rock bears more than 186° a vessel will be eastward of the rock awash 3 cables eastward of Karil rock, and course may be altered gradually south-eastward so as to pass south-westward of Bhubra rock, and thence for Vengurla roads.

This channel should not be used at night, when vessels should pass westward of Vengurla rocks in depths of from 17 to 20 fathoms (31^{m}1 to 36^{m}6).

Chart 902.

Anchorage.—Anchorage may be obtained, with good protection from north-westerly winds, south-eastward of the southern end of Vengurla rocks, in depths of from 11 to 12 fathoms (20^{m}1 to 21^{m}9), mud.

Chart 902, plan of Malvan bay.

Malvan Bay. — Dangers. — Lights. — Beacon. — Buoyage. — Malvan bay is entered between Sindhudurg (Sindhudrug) Janjira and Fort Rajkot, 4½ cables northward. The entrance is encumbered with rocky shoals and the bay is only available for vessels with local knowledge.

Sindhudurg Janjira is a low fortified island on the coastal reef which is joined to the mainland eastward by a drying reef. Foul ground and shoal water, with depths of less than 3 fathoms (5^{m}5), extend about 2¾ cables south-westward, up to 2½ cables westward and about 2¼ cables north-westward from the island.

A light is periodically exhibited, at an elevation of 44 feet (13^{m}4), from the western extremity of Sindhudurg Janjira.

A flagstaff, 70 feet (21^{m}3) high, stands on the south-western side of Fort Rajkot. Foul ground extends about 2¼ cables southward and south-eastward from the fort into Malvan bay.

Johnston Castle rock, consisting of two rocky heads, with depths of less than 6 feet (1^{m}8) over them, lying on a shoal, with depths of less than 3 fathoms (5^{m}5), is situated about 3½ cables westward of the north-western extremity of Sindhudurg Janjira. A black conical buoy, which is withdrawn during the south-west monsoon, is moored about 1¼ cables westward of the western rocky head.

A 16-foot (4^{m}9) patch and a 15-foot (4^{m}6) patch, the latter on the leading line (*see* below), lie about 2¼ and 2¾ cables, respectively, north-westward of the north-western extremity of Sindhudurg Janjira.

Rajkot rock, lying about half a cable northward of this 16-foot (4^{m}9) shoal, has a depth of 12 feet (3^{m}7) over it, and is marked on its south-western side by a red can buoy.

A rock, marked by a perch surmounted by a red cylinder, is situated close northward of the fairway, about 2¾ cables south-south-eastward of Fort Rajkot flagstaff (*Lat. 16° 03′ N., Long. 73° 27′ E.*).

Leading lights, about 2¼ cables apart, are exhibited periodically at the head of Malvan bay:—the front light at an elevation of 20 feet (6^{m}1) from a white mast, 15 feet (4^{m}6) in height, situated on the coast, about 6 cables north-eastward of Sindhudurg Janjira; the rear light at an elevation of 60 feet (18^{m}3) from a steel framework tower, painted white and red in chequers, 45 feet (13^{m}7) in height. These lights in line, bearing 076°, lead through the fairway into Malvan bay.

Charts 740, 2736, 827, 826, 748b.

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Chart 902, plan of Malvan bay.

A tower surmounted by a white cross (*see* view on chart) stands close southward of the leading lights.

The fairway into Malvan bay is buoyed as indicated on the plan; the buoys are withdrawn during the south-west monsoon.

Anchorages.—Anchorage may be obtained off the entrance to Malvan bay, with the northern extremity of Sindhudurg Janjira bearing 095°, and the summit of Kura rock (islet) (page 208), about 3½ miles north-north-westward, bearing 000°, in a depth of 8 fathoms (14m6), mud.

Anchorage is available for vessels with local knowledge in Malvan bay on the leading line with Padmagad (Padamagarh) fort, situated about 2½ cables north-eastward of Sindhudurg Janjira, bearing 163°, in a depth of 13 feet (4m0).

Town.—Supplies.—Communications.—The town of Malvan stands on the northern side of the bay; it is almost hidden by coconut trees. In 1951, it had a population of 29,851.

Fruit and vegetables may be obtained in small quantities.

There is a landing jetty at the custom house, about 4 cables east-north-eastward of the flagstaff on Fort Rajkot.

Local vessels call regularly.

Storm signals.—Storm signals are displayed from the flagstaff on Fort Rajkot; the brief system is used. *See* page 20.

Chart 739.

Coast.—Dangers.—Light.—From Fort Rajkot the coast trends in a general north-north-westerly direction for about 31½ miles to Vijaydurg (Vijayadurg) harbour. The general features of this coast consist of bold rocky capes and small sandy bays, broken by the mouths of numerous streams and creeks.

Chart 902, with plan of Malvan bay.

From Fort Rajkot to a point about 5¾ cables northward, the coast is fringed by a reef which terminates in a rocky spit, extending about 2½ cables north-north-westward from the above-mentioned point; a rock awash lies close within the extremity of this rocky spit. About midway between it and the point is a prominent round-topped rock.

Two rocky heads, awash, lie about three-quarters of a cable north-north-westward of the extremity of the reef fringing the point, about 1½ cables west-north-westward of Fort Rajkot (*Lat. 16° 03′ N., Long. 73° 28′ E.*). A shoal patch, with a least depth of 18 feet (5m5), lies about 1¼ cables north-north-westward of these two rocky heads, and about 2 cables offshore.

A projecting point, 42 feet (12m8) high, is situated about 8½ cables north-north-eastward of the extremity of the rocky spit mentioned above, and between them is a bay known as Chiwallyachi Bandar.

Kolamba (Kolamb) creek flows into the head of Chiwallyachi Bandar. A circular tomb, close southward of which is a tall coconut tree, stands on its southern entrance point, about one mile north-north-eastward of Fort Rajkot flagstaff.

During southerly winds landing may be effected on the southern shore of Chiwallyachi Bandar, but during north-westerly winds the landing is better in Malvan bay.

Chart 902.

Foul ground and shoal water, with depths less than 3 fathoms (5m5),

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Chart 902.

extend about 3 cables south-south-westward and 2 cables westward from the northern entrance point of Chiwallyachi Bandar, and rocky uneven ground, with a least depth of 5¼ fathoms (9m6), lies about 8 cables westward of the same point.

Kalavli creek (Sarjekot river) flows into the sea about half a mile north-north-eastward of the northern entrance point of Chiwallyachi Bandar.

A group of rocks, the southern end of which is situated about 1½ miles north-north-westward of the northern entrance point of Chiwallyachi Bandar, lies about 8 cables offshore; Kura rock (islet), in the centre of this group, is the largest of three rocks, and is 25 feet (7m6) high. Shoals, with depths of 5¼ and 4¾ fathoms (9m6 and 8m7), are situated about 5 and 4 cables, respectively, southward of the southern end of this group.

Chart 739.

Between the entrance to Kalavli creek and the entrance to Achra river, about 6¾ miles north-north-westward, the coast is sandy, with coconut trees. Inland, about 3½ miles eastward of the entrance to Kalavli creek, a range of hills with elevations of between 535 and 675 feet (163m1 and 205m7) extends roughly parallel with the coast. North-north-westward of these summits, and between Kalavli creek and Achra river, the elevations are between 345 and 470 feet (105m2 and 143m3), but there are no conspicuous summits in this range.

About 1¾ miles northward of Kura rock and about half a mile offshore is a 2¼-fathom (4m1) shoal.

Kura patches, lying about 3¾ miles north-north-westward of Kura rock and about 1¼ miles offshore, have a least depth of 5¼ fathoms (9m6) over them.

Achra point, 120 feet (36m6) high, is the north-western entrance point of Achra river, which is, however, only accessible to boats.

A light is periodically exhibited, at an elevation of 162 feet (49m4), from a framework tower, 30 feet (9m1) in height, situated on Achra point.

Between Achra point and Fort point (*Lat. 16° 23′ N., Long. 73° 22′ E.*), the southern entrance point of Deogarh (Devgarh) harbour, about 12 miles north-north-westward, the coast is comparatively regular, though it contains numerous streams and creeks. The cliffs are steep and abrupt, with sandy beaches and coves in some parts. Above the cliffs the land is flat, and farther inland rise hills of bare laterite rock, with little or no vegetation save in the rainy season.

Mombri point projects about half a mile south-westward from the coast, about 1½ miles southward of Fort point, and forms the northern arm of Mombri bay.

Devgarh hill, 250 feet (76m2) high, is situated close to the coast, about 7 miles north-north-westward of Achra point. For radar range *see* Appendix III on page 346.

Ilia hill, 515 feet (157m0) high, lies about 2½ miles east-north-eastward of Devgarh hill.

Saddle hill rises to an elevation of 460 feet (140m2), about 2½ miles eastward of Fort point, and 3½ miles north-north-westward of Ilia hill, and is conspicuous. *See* view [15].

Between the northern entrance point of Deogarh harbour and Burmana point, the southern entrance point of Vijaydurg harbour, about

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Chart 739.

10 miles north-north-westward, the coast is similar to that between Achra point and Fort point, described above.

Round hill, 355 feet (108m2) high, is situated about 2¼ miles north-north-eastward of Fort point, and is conspicuous. *See* view [15].

A conspicuous hill, known as Geriah, rises near the coast, about 5½ miles north-north-westward of Round hill, to an elevation of 325 feet (99m1).

At about 20 miles inland are the Western Ghâts. *See* view [15].

A point projects about a quarter of a mile south-westward from the coast, about 2½ miles southward of Burmana point, and forms the northern arm of a small bay, known as Geriah bay.

Tokul point lies about three-quarters of a mile northward of this projecting point, just mentioned, and is the southern entrance point to a small sandy bay; a sunken rock lies close north-westward of Tokul point (*Lat. 16° 32′ N., Long. 73° 19′ E.*). Tekum point, about half a mile north-north-westward of Tokul point is the northern point of this bay.

Chart 57.

Parweka point, about one mile south-south-westward of Burmana point, is low and rocky; between these two points there is a bight which is foul and shallow.

Mushroom rock is the extremity of a projecting point, about 2 cables southward of Parweka point, and almost midway between it and Tekum point.

Two shoals, each with a least depth of 2¼ fathoms (4m1), are situated about 2 cables north-north-westward and 3 cables northward, respectively, of Parweka point; the latter shoal is about 1½ cables offshore.

From Burmana point, which is 77 feet (23m5) high, Burmana reef, over which the sea breaks, extends in a west-north-westerly direction for about 1½ cables and in a north-north-westerly direction for about 2 cables; a shoal, with a least depth of 4½ fathoms (8m2), lies about 2½ cables north-westward of this point. Burmana reef and the shoal are covered by the *red* sector of Vijaydurg light (page 210), between the bearings of 045° and 090°.

Chart 2736.

Outlying bank.—Tidal streams.—Angria bank, the eastern extremity of which is situated about 65 miles westward of Burmana point, has a least depth of 11 fathoms (20m1) and is composed of sand, shells and coral. The bank is steep-to on all sides, with great depths surrounding it.

The tidal streams set in a north-easterly direction across the bank with the flood tide, and in a south-westerly direction with the ebb.

Chart 59.

Deogarh harbour.—Light.—On the southern side of the entrance to Deogarh (Devgarh) harbour there is a flat rocky peninsula, which attains an elevation of about 120 feet (36m6). This peninsula appears at times like an island, but its southern end is connected with the mainland by a narrow sandy neck, on the north-eastern side of which is situated the town of Deogarh (Devgarh). On the eastern side of the peninsula, at its northern end, there is an old fort, from which its northern extremity derives the name of Fort point. Two towers stand on the peninsula, at elevations of 119 and 130 feet (36m3 and 39m6),

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Chart 59.

about 7 and 4 cables southward, respectively, of Fort point. A third tower is situated about midway between them.

A light is exhibited, at an elevation of 95 feet (29^{m}0), from a white round masonry tower with black bands, 35 feet (10^{m}7) in height, situated on the north-western bastion of the fort.

Round hill, as mentioned above, rises to an elevation of 355 feet (108^{m}2), about 2¼ miles north-north-eastward of Fort point, and is conspicuous.

Between Fort point (*Lat. 16° 23′ N., Long. 73° 22′ E.*) and the mainland, about 3¾ cables northward, is the entrance to the harbour; the fairway is only about 3 cables wide, as foul ground and shoal water extend a short distance offshore on both sides of the channel. Foul ground and shoal water extend about 2½ cables south-south-westward from the northern entrance point.

Deogarh harbour is only available for small vessels. *See* view [15].

Anchorages.—A vessel can obtain anchorage with the northern extremity of Fort point bearing 260°, and Green point, 7 cables south-south-eastward, bearing 180°, in depths of 2½ fathoms (4^{m}6).

A vessel drawing less than 12 feet (3^{m}7) can anchor farther southward where it is smoother.

Tidal streams.—The tidal streams are scarcely perceptible at the anchorage, but during springs the ebb attains a rate of from one to 1½ knots in the entrance to Deogarh river north-eastward of the anchorage.

Outside the harbour the tidal streams are irregular, both in their strength and their direction, being much influenced by the wind; on several occasions they have been observed to set in a north-westerly direction with the flood tide, and in a south-south-westerly direction with the ebb, with a maximum rate of 1½ knots.

Directions.—A vessel proceeding into Deogarh harbour should bring the conspicuous summit of Saddle hill (page 208) to bear 090°, and steer for it on that bearing until eastward of the fort at the northern end of the peninsula, whence a south-easterly course can be steered for the anchorage.

A vessel coming from the northward must be careful to avoid the foul ground and shoal water extending south-south-westward from the northern entrance point.

Town.—Deogarh has regular communication by sea with Bombay during the fine season.

Fresh provisions are scarce.

Storm signals.—Storm signals are displayed at Deogarh; the brief system is used. *See* page 20.

Chart 57.

Vijaydurg harbour.—Light.—Vijaydurg harbour is about 1½ miles wide at its entrance. The village of Vijaydurg (Vijayadurg) is situated about three-quarters of a mile east-south-eastward of Burmana point (*Lat. 16° 33′ N., Long. 73° 19′ E.*).

A projecting rocky point, about 8½ cables east-north-eastward of Burmana point, is 84 feet (25^{m}6) high, and has on it a conspicuous fort; this promontory forms the western side of the entrance to Vághotan river; the land southward, being higher, obscures the fort from vessels in that direction. There are good wells in the fort. *See* view on chart.

A light is exhibited, at an elevation of 59 feet (18^{m}0), from a white

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Chart 57.

steel tower with red horizontal bands, 19 feet (5m8) in height, situated on the north-eastern corner of the fort.

Between the rocky point, on which there is a fort, on the southern side of the harbour, and the cliff, 61 feet (18m6) high, on which there are the ruins of a battery, about 6½ cables east-north-eastward, the depths in the fairway are from 3¼ to 4 fathoms (5m9 to 7m3); within this the depths in the river decrease rapidly to 2 fathoms (3m7).

Charts 57, 739.

There are depths of 2 fathoms (3m7) in Vághotan river, and of 3 to 4¾ fathoms (5m5 to 8m7) in a pool about one mile within its entrance. The channel, as far as the so-called old dock, a cove which dries on the western bank, about 2 miles south-south-eastward of the lighthouse, is close to the western bank. The river is navigable by vessels of 7 feet (2m1) draught as far as Vághotan, a village about 7½ miles east-south-eastward of the lighthouse, where there is a stone jetty.

Anchorages.—During the fine season vessels can anchor anywhere in the harbour where their draught permits, but the most convenient position is about 3½ cables east-north-eastward of the lighthouse in depths of 3½ fathoms (6m4), mud.

A vessel of less than 12 feet (3m7) draught can enter the river, and lie in smooth water about one cable off the landing place, situated about 3 cables south-eastward of the lighthouse. A long vessel should be moored head and stern, with her bow facing the ebb tidal stream, which in the freshets attains a rate of about 4 knots.

Vághotan river affords good shelter to small vessels during the south-west monsoon.

Vijaydurg.—Storm signals.—The village of Vijaydurg is small, and the inhabitants are principally engaged in fishing.

Local vessels call here regularly during the fine season.

Storm signals are displayed at Vijaydurg; the brief system is used. *See* page 20.

Coast.—Between the northern entrance point of Vijaydurg harbour, on which there are the ruins of another battery, and Wagapur point, the southern entrance point of Rajapur bay, about 1¾ miles north-north-westward, the coast consists of cliffs about 70 feet (21m3) high, faced by large masses of laterite. It is indented in many places, and there are no dangers beyond a quarter of a mile offshore.

Rajapur bay.—Lights.—Rajapur bay is entered between Wagapur point and Musargagi point, about one mile north-eastward.

Wagapur point is 69 feet (21m0) high; foul ground extends about 1¼ cables west-north-westward from it. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 96 feet (29m3), from a white masonry tower, 21 feet (6m4) in height, situated on Wagapur point.

Musargagi point is 68 feet (20m7) high. An octagonal stone tower stands at an elevation of 103 feet (31m4) about 3 cables north-eastward of the point.

Chart 57.

A light is periodically exhibited, at an elevation of 114 feet (34m7), from a framework tower, 30 feet (9m1) in height, about 1½ cables eastward of Musargagi point.

Holi hill, 273 feet (83m2) high, about 2¼ miles eastward of Wagapur point (*Lat. 16° 36′ N., Long. 73° 20′ E.*), is a round sloping hill on the

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Chart 57.

eastern side of Rajapur bay; it is prominent and can be distinguished from the tableland in its vicinity which is faced with steep cliffs, and everywhere presents almost the same appearance.

Charts 57, 739.

Rajapur river flows into the head of Rajapur bay, at its northern end; on the northern side of the river, a short distance within its entrance, is Ghera Yashvantgad (Yashwantgarh fort), the ruins of an old fort overrun by trees and jungle.

There are depths of from one to 1¼ fathoms (1m8 to 2m3) on the bar of this river, and farther in, abreast the large village of Jaytápur (Jaitapur), which is situated on the left bank of the river, about one mile within its entrance, depths of from 2½ to 4 fathoms (4m6 to 7m3).

About 15 miles up Rajapur river is the town of Rajapur, a place of some importance, but the river is not navigable as far as this.

Local vessels call regularly at Rajapur bay.

Storm signals.—Storm signals are displayed at Jaytápur; the brief system is used. *See* page 20.

Chart 57.

Anchorages.—Rajapur bay affords anchorage in depths of from 4 to 5 fathoms (7m3 to 9m1). It is protected from the strong north-westerly winds which sometimes blow during the fine season, but with westerly winds there is a heavy short swell in the bay, when the anchorage is not safe; small craft can then proceed into Rajapur river.

Talsunda (Tulsunda) cove, situated in the south-eastern corner of Rajapur bay, about one mile eastward of Wagapur point, has depths of from 1½ to 2½ fathoms (2m7 to 4m6). It is accessible to a small vessel, and affords good shelter during south-westerly gales.

Coast.—Dangers.—Buoy.—Between Musargagi point and Abulgadh (Ambolgarh) point, about one mile north-north-westward, there is a bay, called Abulgadh (Ambolgarh) bay, which has a sandy beach at its head. Within this beach there are low flat ridges of laterite, on the southern side of which there is a valley, and the remains of extensive salt works.

About a quarter of a mile north-eastward of Abulgadh point is the village of Abulgadh (Ambolgarh).

Abulgadh (Ambolgarh) reef, situated on the northern side of the entrance to Abulgadh bay, about 2½ cables south-westward of Abulgadh point, has a small drying patch in its centre; the sea breaks heavily over this reef.

A black conical buoy is moored about 5 cables south-westward of the south-western edge of this reef; this buoy is withdrawn during the south-west monsoon.

Musargagi point in line with Holi hill, bearing 109°, leads southward of Abulgadh reef.

Chart 739

Between Abulgadh point (*Lat. 16° 38′ N., Long. 73° 20′ E.*) and Váda Veta (Yetia), about 3¼ miles northward, the coast is sandy. Near the coast the hills are between 158 and 322 feet (48m1 and 98m1) high. Farther inland there are summits of 468 and 495 feet (142m6 and 150m9), situated about 4 miles east-north-eastward and north-eastward, respectively, of Abulgadh point.

From Váda Veta the coast trends northward for about 7 miles to the entrance to Purngad creek (Muchkundi river), and consists of rocky

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Chart 739.

tableland. A conspicuous hill, known as Lamblekri, rises to an elevation of 326 feet (99m4), about one mile north-westward of Váda Veta.

On the southern side of the entrance to Purngad creek is the town of Gaonkhadi (Pent), and on the northern side of the entrance, on the brow of a barren hill, are the ruins of a fort. Purungarh bay is an indentation in the coast into which Purngad creek flows.

A hill, known as Khavri, rises to an elevation of 1,129 feet (344m1) about 10 miles eastward of the entrance to Purngad creek.

From Purungarh bay the coast trends north-north-westward for about 4¾ miles to Paos bay, and consists of rocky tableland and sandy indentations; it is free from dangers.

A light is periodically exhibited, at an elevation of 230 feet (70m1), from a framework tower, 30 feet (9m1) in height, situated on the coast about one mile north-westward of the entrance to Purngad creek.

Between Purngad creek and Ratnágiri, about 11 miles northward, the land rises gradually from the coast in undulating hills, which attain elevations of from 600 to 700 feet (182m9 to 213m4) about 5 to 6 miles inland; there are no prominent features, with the exception of Chandralli, 916 feet (279m2) high, a round wooded hill, 8 miles east-north-eastward of Paos bay.

Paos bay.—Light.—Anchorage.—The entrance to Paos bay is about three-quarters of a mile wide; the northern entrance point is known as Paos point.

A light is periodically exhibited, at an elevation of 170 feet (51m6), from a framework tower, 30 feet (9m1) in height, situated on Paos point.

Paos bay affords anchorage, with shelter from strong north-westerly winds, in depths of from 4 to 5 fathoms (7m3 to 9m1), mud and sand.

Golap hill, 390 feet (118m9) high, is situated about one mile north-eastward of Paos point.

Charts 56, 739.

Ratnágiri bay.—Lights.—Depths.—Dangers.—Kushipur point (*Lat. 16° 57′ N., Long. 73° 17′ E.*), the southern entrance point of Ratnágiri bay, lies about 3¾ miles northward of Paos point. The entrance to the bay is about 2 miles wide, but no shelter is afforded during the south-west monsoon when smooth-water anchorage can be found in Kalbadivi bay, about 4 miles northward. *See* view [16].

Chart 56.

The Fort, on the northern side of the entrance, is an old Mahratta structure, covering a bold and conspicuous headland of laterite, 200 to 300 feet (61m0 to 91m4) high, with cliffs; from a distance it appears like an island; it is connected with the mainland by a sandy neck. *See* view on chart.

A light is exhibited, at an elevation of 325 feet (99m1), from a white steel tower, 40 feet (12m2) in height, situated on the southern bastion of The Fort.

Ratnágiri river flows into the head of the bay, about 1¼ miles eastward of The Fort; it is only navigable by small craft at high water.

In January and February large numbers of canoes are engaged in sardine fishing.

In the northern half of the bay the depth in the entrance is about 6 fathoms (11m0), decreasing gradually eastward, but abruptly to the reef in the northern part; the bottom is sand and mud. In the southern

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Chart 56.

half of the bay the depths are less than 5 fathoms (9m1), and the bottom is rocky.

Two shoals, with depths of 4¾ fathoms and 4½ fathoms (8m7 and 8m2), lie about 9 cables south-westward and 5½ cables westward, respectively, of Kushipur point.

A reef, with depths of less than 3 fathoms (5m5) over it, extends about 6¼ cables north-north-westward from Kushipur point; near its centre lies Brum Mudle rock, above water, over which the sea breaks heavily during the south-west monsoon.

A detached 3-fathom (5m5) shoal lies about 5¾ cables north-westward of Kushipur point.

A 2¾-fathom (5m0) shoal lies about one mile south-eastward of The Fort light-structure.

From the coast, about 6¾ cables east-north-eastward of the northern entrance point, a reef, on which the sea breaks heavily in bad weather, extends in a south-south-westerly direction for about 3½ cables; there is a depth of 4¾ fathoms (8m7) close southward of the southern edge of this reef.

A light is periodically exhibited, at an elevation of 15 feet (4m6), from a white iron column, 24 feet (7m3) in height, situated about half a mile eastward of The Fort light-structure.

Anchorages.—At the beginning or close of the south-west monsoon, vessels should anchor with the saw-mill chimney, situated about 1¼ miles eastward of The Fort light-structure, bearing 067°, and the lighthouse on The Fort bearing 000°, in a depth of 6 fathoms (11m0).

During the fine season vessels can anchor with the custom house, situated about three-quarters of a mile east-north-eastward of The Fort light-structure, bearing 045°, and the lighthouse on The Fort bearing 315°, in a depth of 5¼ fathoms (9m6). A shallow-draught vessel can anchor farther northward.

Landing.—The landing place in Ratnágiri bay, during the north-east monsoon, is at a stone jetty near the custom house; a good look-out must however be kept by boats approaching it, as extensive reefs project from the coast, and isolated patches of rock lie scattered about; these latter are covered with kelp and seaweed, are nearly awash and the sea does not always break on them. During westerly breezes, which sometimes set in during the fine season and occasionally last for three days, a considerable swell often sets in, and landing here becomes hazardous; on such occasions the bight on the northern side of The Fort headland may be used.

In the south-west monsoon there is a very heavy surf in the bay, and landing is then generally impracticable.

Ratnágiri.—The town of Ratnágiri lies on the northern side of the river entrance, on the brow of a flat ridge, about 150 feet (45m7) high. In 1951, it had a population of 27,082.

Fresh water, fruit and vegetables are obtainable in moderate quantities.

During the fine season there is regular communication by sea with other coastal ports. During the south-west monsoon the mail steamers land passengers and cargo at Kalbadivi bay.

There is a hospital at Ratnágiri (*Lat. 16° 59′ N., Long. 73° 18′ E.*).

Storm signals.—Storm signals are displayed from the lighthouse on The Fort; the brief system is used. *See* page 20.

Charts 739, 2736, 826, 748b.

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Chart 56.

Radio.—There is a radio station at Ratnágiri. *See* page 24.

Climatic table.—*See* page 51.

Coast.—Dangers.—Lights.—Mirya bay lies between Galee point, the northern extremity of The Fort headland, and Miyet point, the south-western extremity of Vada Mirya (Mirya Donghur), about 1½ miles north-north-westward; the shore at the head of this bay is covered with coconut palms, and is fronted by a ridge of sandhills. Inland there is an extensive flat of mud and sand, overgrown with mangroves and covered at high-water springs; Shirgaon (Sirgaum) creek winds through this flat, and connects Ratnágiri with Kalbadivi bay, about 3 miles north-north-westward. *See* view [16].

Mudle or Taylor shoal lies near the middle of Mirya bay, about 6½ cables south-eastward of Miyet point; it has a least depth of three-quarters of a fathom (1m4) and the sea breaks over it at low water.

Vada Mirya is a high headland of bare laterite rock with steep cliffs facing the sea; it is lighter in colour than the adjacent land and resembles an island when seen from northward or southward. A conspicuous summit known as Mirya peak, about half a mile north-north-eastwards of Miyet point, is 473 feet (144m2) high, and has a disused flagstaff on its summit. *See* view on chart.

Tonkul peak rises to an elevation of 377 feet (114m9), about 9 cables northward of Mirya peak.

Between Sookana point, the north-western point of Vada Mirya, and Kurne point, 147 feet (44m8) high, about 2½ miles north-eastward, the coast recedes, forming an indentation known as Kalbadivi bay.

About three-quarters of a mile east-south-eastward of Sookana point is the confluence of Shirgaon creek and Kalbadivi river, which rises some distance inland; on the northern side of the entrance to this river is the village of Vada Kalbadivi, where there are some temples. Large native craft can proceed up Shirgaon creek at high water.

Sookana shoal, situated about 1½ miles north-westward of Sookana point, has a least depth of 5¼ fathoms (9m6), coral.

Chart 739.

Neori point, a salient point, 208 feet (63m4) high, is situated about 2 miles north-north-westward of Kurne point (*Lat. 17° 05′ N., Long. 73° 17′ E.*).

From Neori point the coast trends north-north-westward for about 5½ miles to Warori bluff, a conspicuous promontory, 230 feet (70m1) high, on the northern side of which is a small bay into which flows a stream; there are depths of from 6 to 7 feet (1m8 to 2m1) over the bar of this stream at high water.

A light is periodically exhibited, at an elevation of 165 feet (50m3), from a framework tower, 30 feet (9m1) in height, situated on Warori bluff about half a mile south-eastward of its north-western extremity.

The village of Malgund (Malgom) lies on the coast midway between Neori point and Warori bluff.

The conspicuous summit of Bhogtembi rises to an elevation of 985 feet (300m2) about 9 miles east-south-eastward of Neori point.

Between Warori bluff and Ambwah point, the southern extremity of Jaigarh headland, 4¼ miles north-north-westward, there is a series of sandy bays and rocky points.

Kaljhondie, 739 feet (225m2) high, is situated about 5 miles east-

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Chart 739.

ward of Warori bluff; on the summit there is a tree which is conspicuous when viewed from southward.

Ambwah bay lies on the eastern side of Ambwah point. An indentation in the coast about one mile northward of Ambwah point is known as Nadura bay.

Fishing stakes may be encountered between 3 and 4 miles westward of Jaigarh headland, and, consequently, vessels should not proceed into depths of less than 15 fathoms (27m4) at night.

Kardeshwar point 96 feet (29m3) high, the north-western point of the headland, appears from seaward to be a level and almost barren plateau terminating in steep cliffs faced with laterite rocks; an ancient Hindu temple stands on the steep face of the cliffs. *See* view **[16]**. Foul ground extends about 1¾ cables westward and northward from this point.

A light is exhibited, at an elevation of 133 feet (40m5), from a black iron tower with white bands, 72 feet (21m9) in height, situated on the western point of Jaigarh headland (*Lat. 17° 18′ N., Long. 73° 12′ E.*). *Chart 56.*

Anchorages.—Mirya bay affords anchorage to small vessels in the northern part of the bay, with shelter from north-westerly winds, in depths of from 3 to 4 fathoms (5m5 to 7m3), mud and sand; care must be taken to avoid Mudle shoal. Should a southerly gale occur during the fine season vessels can anchor on the southern side of Mirya bay, northward of The Fort headland.

There is no anchorage in this bay during the south-west monsoon, as a heavy sea then rolls in and breaks in depths of from 2 to 3 fathoms (3m7 to 5m5).

Kalbadivi bay affords anchorage at the southern end of the bay, about 7 cables eastward of Sookana point and about 2½ cables offshore, in a depth of 4½ fathoms (8m2). Local coastal vessels call here during the south-west monsoon. *See* view **[16]**.

Chart 739.

A small vessel with local knowledge can obtain sheltered anchorage on the northern side of Warori bluff, during the south-west monsoon, in depths of 3 fathoms (5m5), mud.

Ambwah bay affords anchorage east-south-eastward of Ambwah point, with shelter from north-westerly winds, in depths of 4 fathoms (7m3), sand and mud.

Storm warnings.—Storm warnings are received at Malgund but no signals are hoisted. *See* page 23.

Jaigarh bay.—Lights.—Jaigarh bay is entered between the northern extremity of Jaigarh headland and a point about 1¾ miles north-eastward; Shāstri or Sangameswar river flows into the head of this bay. The estuary of Shāstri river forms a well-sheltered convenient harbour tolerably easy of access, even during the south-west monsoon, for vessels of about 15 feet (4m6) draught, possessing local knowledge. *See* view **[17]**.

Jaigarh fort, situated on a rocky point, about 1¾ miles eastward of Jaigarh lighthouse, is an old Mahratta fortress, in which there are a few houses. The village of Jaigarh extends along the coast for a distance of about three-quarters of a mile southward from the fort.

A light is exhibited, at an elevation of 135 feet (41m1), from a white framework tower, 30 feet (9m1) in height, situated about half a mile

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Chart 739.

north-eastward of Jaigarh Headland light-structure when vessels are entering or leaving harbour.

A light is exhibited from a bastion at the north-eastern corner of Jaigarh fort, and another one from a post near the custom house, about 2½ cables south-south-eastward of the fort (*Lat. 17° 18′ N., Long. 73° 14′ E.*).

The north-eastern side of Jaigarh bay is composed of ridges of bare hills with steep cliffy sides, and small sandy indentations at the mouths of the valleys which separate these ridges; these coastal hills are from about 200 to 300 feet (61^{m}0 to 91^{m}4) high.

Tousal point projects from the eastern side of the bay, about one mile east-north-eastward of Jaigarh fort; the ruins of an old battery, known as Trize Kila, are situated about one cable south-south-eastward of the point. *See* view [17].

The north-eastern entrance point of Shāstri river, about half a mile southward of Tousal point, is a sandy point with coconut trees on it; eastward of this the northern side of the river consists of hilly slopes.

Dangers.—Buoyage.—Foul ground extends about 1¾ cables westward and northward from Kardeshwar point.

A shoal, with a least depth of 17 feet (5^{m}2), is situated on the north-eastern side of the entrance to Jaigarh bay, with its southern extremity about 3½ cables west-north-westward of the north-eastern entrance point.

Katane reef, which dries, lies about 1½ cables south-westward of the north-eastern entrance point.

The bar of Shāstri river extends in a northerly direction from the coast just westward of Jaigarh fort to the north-eastern side of Jaigarh bay; Bar sand is a large detached shoal, with its southern end about 2 cables north-north-westward of the fort and about 1½ cables offshore.

The channels northward and southward of Bar sand have depths of from 13 to 16 feet (4^{m}0 to 4^{m}9), but these are probably subject to change.

Barrel buoys are moored off the edge of the coastal reef about 7 and 3½ cables, respectively, west-north-westward of the light-structure on Jaigarh fort; the former is painted black and white in chequers, with a conical topmark, and the latter red and white in chequers, with a red can topmark.

Mora sands, which dry, extend about 8 cables westward from the north-eastern entrance point of Shāstri river, leaving a navigable channel about one cable wide westward of them.

A barrel buoy, painted red and white in chequers, and surmounted by a red can topmark, is moored off the point about 7 cables south-south-eastward of the light-structures on Jaigarh fort (*Lat. 17° 18′ N., Long. 73° 14′ E.*).

Anchorages.—There is anchorage in Damankul bay, about 4 cables eastward of Kardeshwar point in depths of from 26 to 29 feet (7^{m}9 to 8^{m}8).

There is also an anchorage charted about three-quarters of a mile north-eastward of Kardeshwar point in depths of 5 to 6 fathoms (9^{m}1 to 11^{m}0).

There is good sheltered anchorage about one mile within the bar of Shāstri river close eastward of Jaigarh village, in charted depths of from 4 to about 9 fathoms (7^{m}3 to 16^{m}5). The best anchorage is

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Chart 739.

about 7 cables south-eastward of the light near the custom house and about 2½ cables offshore, with Jaigarh Fort light bearing 323°, in depths of 28 feet (8m5).

Directions.—A vessel approaching Jaigarh bay from southward should not close Kardeshwar point to within a distance of 3 cables, on account of the foul ground extending westward and northward from it.

A vessel of sufficiently light draught to cross the bar can, when the point on which Jaigarh fort stands bears 109°, steer for it on that bearing until within a distance of about 4 cables, when course can be altered a little northward to pass through the fairway of the channel southward of Bar sand. When abreast Jaigarh fort course can be altered gradually southward, passing about half a cable north-eastward and eastward of the fort; the eastern extremity of the fort in line with the north-eastern entrance point of Jaigarh bay, bearing about 349°, leads through the fairway westward of Mora sands.

If intending to cross the bar northward of Bar sand, vessels should steer a south-easterly course through the fairway. When the eastern extremity of Jaigarh fort bears 165° a vessel can alter course southward, and steer for it on that bearing, and proceed as directed above.

Jaigarh.—Storm signals.—Jaigarh, which is a fishing village, is in regular communication by sea, during the fine season, with Bombay, also with the ports southward as far as Goa.

Storm signals are displayed from the lighthouse on Jaigarh headland (*Lat. 17° 18′ N., Long. 73° 12′ E.*); the brief system is used. *See* page 20.

Shāstri river.—Shāstri river is tidal as far as Sangameshwar, an important town about 28 miles from its mouth; about 18 miles from its entrance it receives the waters of three tributaries, Bao, Gurni and another stream. Shāstri river is shallow but free from dangers in the fairway.

Kurli sand, the western extremity of which is about 1½ miles east-south-eastward of the light near the custom house (page 217), lies on the southern side of the river, just within its entrance; it is about one mile long and narrow, and is composed of sand and mud, which dry.

The channel on the northern side of Kurli sand has a least depth of 19 feet (5m8) in the fairway; the channel southward of Kurli sand is shallow.

Coast.—Dangers.—Lights.—Between the north-eastern entrance point of Jaigarh bay and Boria headland, about 3½ miles north-north-westward, the coast is composed of small sandy bays divided by rocky points; Boria bay lies on the south-eastern side of Boria headland.

Boria headland attains an elevation of 386 feet (117m6); the top of the ridge has several summits close together. The north-western point of this headland is 360 feet (109m7) high, and there is a small, but conspicuous, Hindu temple, known as Boria pagoda, just within the summit of the point.

A light is periodically exhibited, at an elevation of 123 feet (37m5), from a framework tower, 30 feet (9m1) in height, situated on the south-eastern extremity of Boria headland.

Charts 738, 739.

From the north-western point of Boria headland the coast trends in

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Charts 738, 739.

a north-easterly direction for about 1¾ miles to Palshet bay, which is about half a mile wide at its entrance.

A light is periodically exhibited, at an elevation of 192 feet (58m5), from a framework tower, 30 feet (9m1) in height, situated on the northern entrance point of Palshet bay. This light is obscured by high land when bearing more than 141°.

Chart 738.

For about one mile northward of the northern entrance point of Palshet bay, there are high cliffs, which rise to an elevation of 330 feet (100m6) close inland near their northern extremity. From thence a sandy beach extends north-north-westward for about 3¾ miles. A large village, called Guhagar, extends parallel with the beach close inland.

Chart 738, with plan of Port Dabhol.

Tolkeshwar point (*Lat. 17° 34′ N., Long. 73° 09′ E.*), the southern entrance point of Váshishti river, about 8 miles north-north-westward of Palshet bay, is a bold point, faced with cliffs, about 300 feet (91m4) high; there is an ancient Hindu temple and a prominent clump of trees on its summit. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 342 feet (104m3), from a white masonry tower, 30 feet (9m1) in height, situated on Tolkeshwar point. On account of its height the light may be occasionally obscured by clouds.

Chart 738, plan of Port Dabhol.

A rocky ledge, on which there is a prominent pinnacle rock 20 feet (6m1) high, fringes Tolkeshwar point; close to this pinnacle rock are some drying rocks.

Ranwee point lies about half a mile southward of Tolkeshwar point with a huge boulder and an overhanging cliff close northward of it.

Storm signals.—Storm signals are displayed from Tolkeshwar Point lighthouse; the brief system is used. *See* page 20.

Chart 739.

Anchorage.—Small vessels can obtain anchorage in Boria bay with shelter from north-westerly winds, in depths of from 4 to 5 fathoms (7m3 to 9m1), mud.

Chart 738.

Caution.—Between Boria headland and Khānderi island about 80 miles northward, fishing stakes and logs are liable to be encountered in depths of up to 10 fathoms (18m3) and occasionally up to 12 fathoms (21m9). The area in which fishing stakes are not allowed is indicated on the chart. but nevertheless they may sometimes be found in it.

Chart 738, plan of Port Dabhol.

Port Dabhol.—Port Dabhol is situated in the estuary of Váshishti river, about 2¼ miles east-north-eastward of Tolkeshwar Point lighthouse (*Lat. 17° 34′ N., Long. 73° 09′ E.*).

There is a stone jetty at Dabhol, with a depth of 9 feet (2m7) alongside where small vessels can lie.

Vessels of 10 feet (3m0) draught can proceed up Váshishti river at all times as far as Karbone, 16 miles above Dabhol, and thence to Chiplun, about 10 miles farther up, at high water only.

Aspect.—Landmark.—The land on both sides of the entrance to the river is hilly and undulating, attaining elevations of from 300 to 400 feet (91m4 to 121m9), the hills sloping steeply down to the coast,

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Chart 738, plan of Port Dabhol.

and in places terminating in cliffs varying between 15 and 80 feet (4^{m}6 and 24^{m}4) in elevation.

Pir Balu, a conical hill, 835 feet (254^{m}5) high, situated about 4½ miles east-north-eastward of Tolkeshwar Point light, has a dome-shaped tomb on its summit; it forms an excellent landmark, as its sharp summit can be distinguished above the flat ridges of laterite rock in this locality.

Anjanvel (Anjanwel) fort, which is in ruins, stands on a hill, on the southern side of the entrance to Váshishti river, about 7 cables east-north-eastward of Tolkeshwar Point light.

Anjanvel (Anjanwel) bay lies eastward of Anjanvel fort; it is shallow and there is a heavy swell there at times. The town of Anjanvel (Anjanwel) is situated on the western side of this bay.

Veldur (Yeldur) hill, on the eastern side of Anjanvel bay, is 267 feet (81^{m}4) high; Veldur (Yeldur) bay lies on the eastern side of Veldur hill.

Pilot.—On application to the Sarkarkun (customs and port officer), the services of a local uncertificated pilot can be obtained.

Dangers.—Buoys.—The bar, which has a least depth on the leading line of 11 feet (3^{m}4), extends about 6¾ cables north-westward from Tolkeshwar point (*Lat. 17° 34′ N., Long. 73° 09′ E.*); a black can buoy which is removed during the south-west monsoon, marks the north-western edge of the bar.

Churpulti sand, which dries, extends about 1½ miles west-south-westward from Sil point, the northern entrance point of Váshishti river; it is marked at its western edge by a black can buoy, which is removed during the south-west monsoon, and about 3 cables south-westward of Sil point by a barrel buoy, painted in red and white chequers and surmounted by a red can topmark.

Lights.—Leading lights, about 7 cables apart, are periodically exhibited on the southern side of Váshishti river. The front light is exhibited, at an elevation of 36 feet (11^{m}0), from a wooden mast surmounted by a diamond, 16 feet (4^{m}9) in height, situated on the point close northward of Anjanvel fort. The rear light is exhibited, at an elevation of 98 feet (29^{m}9), from a white steel tower, 12 feet (3^{m}7) in height, situated on the northern slope of Veldur hill. These lights in line bear 081°.

A light is periodically exhibited, at an elevation of 24 feet (7^{m}3), from a wooden mast, 17 feet (5^{m}2) in height, situated on the south-western corner of the jetty at Dabhol.

Tidal streams.—The tidal streams set in a north-easterly direction over the bar with the flood tide, and in a south-westerly direction with the ebb, attaining a rate of about 1½ knots.

Inside the bar the tidal streams set into Anjanvel bay with the flood and on to Churpulti sand with the ebb.

Farther up the river the streams follow the direction of the channel, and have a rate of about 3 knots.

The flood stream continues for about one hour after high water, and the ebb for about one hour after low water; occasionally at neaps the ebb commences one hour before high water.

Anchorage.—Anchorage can be obtained in mid-stream, southward of the jetty at Dabhol, in charted depths of from 27 to 29 feet (8^{m}2 to 8^{m}8), mud.

Charts 2736, 826, 748b.

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Chart 738, with plan of Port Dabhol.

Directions.—A vessel intending to enter Váshishti river should not proceed into depths of less than 5 fathoms (9m1) until Tolkeshwar Point lighthouse (*Lat. 17° 34′ N., Long. 73° 09′ E.*) bears 095°. When the lighthouse is on this bearing distant about 1½ miles, the leading lights on the southern side of the river should be brought in line, bearing 081°; this will lead over the bar in a depth of 11 feet (3m4). Care must be taken to avoid fishing logs, which are frequently found moored both inside and outside the river.

When Tolkeshwar Point lighthouse bears 180° vessels should shape course to pass about three-quarters of a cable northward of Anjanvel light-mast, and when the latter bears 180° alter course so as to steer in mid-channel, keeping about 1¼ cables offshore, so as to avoid the coastal reef which extends about half a cable offshore in the vicinity of Veldur hill.

Chart 738, plan of Port Dabhol.

Dabhol.—Dabhol, a small town on the northern side of the entrance to Váshishti river, lies at the foot of the hills. Near the jetty is the custom house and a large mosque. Two conspicuous houses are situated about half a mile north-westward and west-north-westward, respectively, of the custom house.

There is regular communication by sea with Hárnai, Bánkot and Bombay.

Storm signals.—Storm signals are displayed from the jetty at Dabhol; the brief system is used. *See* page 20.

Chart 738.

Coast.—Dangers.—Light.—From Sil point, the northern entrance point of Váshishti river, the coast trends in a general north-northwesterly direction for 25 miles to the entrance to Savitri river and Port Bánkot. It consists of a series of plateaux, varying in elevation from 500 to 700 feet (152m4 to 213m4), with two conspicuous peaks, viz., Gimona peak, 988 feet (301m1) high, about 13¼ miles northward of Sil point, and Kanta, 1,115 feet (339m8) high, about 10 miles north-north-westward of Gimona peak. In places there is a narrow strip of land between the plateau and the coast, but generally the seaward slopes are abrupt. Trees are scarce, and the vegetation consists of sparse bushes.

There are no shoals to be met between the entrances to Váshishti and Savitri rivers if a vessel keeps from about 1½ to 3 miles offshore, and does not proceed into depths of less than 5 fathoms (9m1). Care, however, must be taken to avoid the logs, marking fisheries, which are to be met with during the fine season about 5 miles westward of the entrance to Jog river, which is situated about 16 miles north-north-westward of Sil point.

Burundi bay is situated about 8 miles northward of the entrance to Váshishti river; it has a village called Karanjgaon (Burundi) at its head.

At Hárnai (*Lat. 17° 48′ N., Long. 73° 06′ E.*), about 5¾ miles north-north-westward of Karanjgaon, the land projects, forming a promontory fringed with rocks; close southward of this promontory is an islet from which sunken rocks extend about 3 cables westward.

A light is exhibited, at an elevation of 95 feet (29m0), from a white masonry tower, 32 feet (9m8) in height, situated on the above islet.

Hárnai is a small town at which local vessels call regularly.

Charts 2736, 826, 748b.

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Chart 738.

Janjira (Savaradrug fort), about half a mile north-westward of Hárnai promontory, is a fortified islet, 62 feet (18^{m}9) high and covered with vegetation; this islet lies under a range of hills, and is not easily identified from seaward.

An obstruction, the position of which is approximate, was reported, in 1926, by the s.s. *Amravati*, about 4 miles north-westward of Janjira.

From a point about 5¾ miles north-north-westward of Janjira a reef extends north-westward for about half a mile, with shoal water extending about half a mile farther north-westward; a 3-fathom (5^{m}5) shoal lies about half a mile west-south-westward of this point.

Gogul point lies about 3 miles north-north-westward of the above point.

Storm signals.—Storm signals are displayed from the lighthouse on the islet southward of Hárnai promontory; the brief system is used. *See* page 20.

Anchorages.—Burundi bay affords anchorage to small vessels, with some shelter from southerly winds, in depths of 2 fathoms (3^{m}7).

Hárnai promontory affords shelter only to boats from north-westerly winds.

Caution.—*See* caution on page 219 regarding fishing stakes and logs.

Port Bánkot.—Landmarks.—Beacon.—Port Bánkot is situated from one to 2 miles within the bar at the entrance to Savitri river.

From close northward of Gogul point a sandspit, covered with creepers, extends northward for about three-quarters of a mile, terminating close westward of Rankuran point, the southern entrance point of Savitri river.

Devgarh (Devgad) point, 180 feet (54^{m}9) high, is the northern entrance point of the river, and is situated about 1½ miles north-north-westward of Rankuran point.

The following landmarks are conspicuous and easily identified:—The high black walls of the ruins of Fort Victoria, at an elevation of 459 feet (139^{m}9), situated about three-quarters of a mile east-northeastward of Rankuran point; close under the walls of the fort is an English cemetery, in which there is a high memorial pillar and a large pyramidal headstone, both of which are conspicuous from outside the bar; Hareshvar (Hariharéshwar) hill, small, dark, conical and 351 feet (107^{m}0) high, about 3½ cables eastward of Devgarh point; and Hareshvar Donghur, 409 feet (124^{m}6) high, about three-quarters of a mile north-eastward of Hareshvar hill.

From Fort Victoria (*Lat. 17° 58′ N., Long. 73° 03′ E.*) the hill slopes gradually to Panbruj point, about 7½ cables north-eastward of Rankuran point; about three-quarters of a cable north-eastward of Panbruj point there is a fort, with a white obelisk, known as Panbruj beacon, which, in 1925, was badly in need of repair.

The banks of the river are steep. The hills are covered with grass and scrub, with patches of cultivation along the coast; on the slopes above the town of Bánkot, which is situated on the southern side of the river, about a quarter of a mile eastward of Panbruj Point fort are large plantations of mango and oondini trees.

Pilot.—The services of a local uncertificated pilot can be obtained on application to the Sarkarkun (customs and port officer).

Depths.—Buoys.—The entrance to the channel over the bar was,

Charts 2736, 826, 748b.

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Chart 738.

in 1925, situated about one mile westward of Rankuran point, and in that year a least depth of 8 feet (2m4) could be carried over the bar.

The entrance to the channel over the bar is marked by a black conical buoy on the southern side and by a red can buoy on the northern side.

A red can buoy, marking the southern edge of the drying sandbank on the northern side of the channel, is moored about 4½ cables north-north-westward of Rankuran point; the sea breaks heavily over this sandbank.

These buoys are withdrawn during the south-west monsoon.

The depths gradually increase within the bar, and at a distance of about 7 cables within there are depths of from 20 to 33 feet (6m1 to 10m1); off Panbruj Point fort there is a pool with depths of from 31 to 34 feet (9m4 to 10m4) in it. At the anchorage opposite the custom house at Bánkot, which is situated about 2¾ cables east-north-eastward of Panbruj beacon, there are depths of from 24 to 28 feet (7m3 to 8m5).

Tidal streams.—The tidal streams set over the bar in a north-north-easterly direction with the flood, and in a south-south-westerly direction with the ebb, attaining a rate of about three-quarters of a knot at springs.

Between the bar and the anchorage off Bánkot the flood tide sets slightly towards the sandbanks on the northern side of the channel, while the ebb follows the direction of the channel.

At the anchorage off Bánkot the rate of the tidal streams at springs is about 2½ knots.

Outer anchorage.—A vessel may anchor in depths of from 4 to 5 fathoms (7m3 to 9m1), outside the bar off Port Bánkot, but entrance to the river should not be attempted without local knowledge, as the position of the channel over the bar is liable to change.

Directions.—Panbruj beacon bearing 067° led, in 1925, between the bar buoys and across the bar.

Caution is required in crossing the bar, as during westerly breezes, which sometimes blow strongly in the fine season, there are heavy breakers over it, and, except in the calmest weather, there is always a cross sea.

When a vessel is within about half a mile of the beacon she should alter course a little northward so as to pass north-westward of it at a distance of three-quarters of a cable, and anchor in mid-stream according to draught.

Boats should not cross the sandbank on the northern side of the river, without local knowledge.

Bánkot.—The town of Bánkot (*Lat. 17° 59′ N., Long. 73° 03′ E.*), situated on the southern side of the river, above Panbruj fort, extends some distance along the coast. Until 1822 Bánkot was the chief town of Ratnágiri district; now it is little more than a fishing village. The inhabitants are principally agriculturists and fishermen.

There is a small stone jetty near the centre of the village for working cargo.

During the fine season local vessels call regularly, anchoring southward of Devgarh point.

Savitri river.—Above Bánkot the river becomes a narrow stream, and there are numerous fishing stakes near and above the village

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Chart 738.

which impede navigation, but a vessel drawing 6 feet (1m8) can navigate as far as Mahad, 30 miles above Bánkot.

Coast.—Dangers.—Buoy.—Lights.—From Devgarh point the coast trends north-north-westward for about 2 miles to Srivardhan point, the southern entrance point of Srivardhan bay.

Shoal water, with depths of less than 3 fathoms (5m5), extends about one mile offshore from this part of the coast; a 2-fathom (3m7) rocky shoal is situated about half a mile south-westward of Srivardhan point.

Srivardhan bay, which is about 1¾ miles wide at its entrance, is shallow; the town of Srivardhan is situated at the head of the bay.

From the northern entrance point of Srivardhan bay the coast trends north-north-westward for about 5 miles to the southern entrance point of Kumbaru bay; the coastal reef, with depths of less than 3 fathoms (5m5), extends in places to about three-quarters of a mile offshore.

A light is periodically exhibited, at an elevation of 152 feet (46m3), from a framework tower, 30 feet (9m1) in height, situated on the south-western side of the promontory at the northern end of Srivardhan bay.

A 2¾-fathom (5m0) patch lies about 1¼ miles north-north-westward of the above light.

Matgarh hill, which is conspicuous, rises to an elevation of 959 feet (292m3), about 3¼ miles east-north-eastward of the southern entrance point of Kumbaru bay.

Kumbaru bay is about 5½ miles wide at its entrance. The large village of Āgar Panchaitan (Deowahu) lies a short distance inland at the head of the bay, about 4¼ miles northward of the southern entrance point.

In the bay the coastal bank, with depths of less than 3 fathoms (5m5), extends up to 1¼ miles offshore and there is a 3-fathom (5m5) patch about 2 miles north-north-westward of the southern entrance point.

Kumbaru point (*Lat. 18° 13′ N., Long. 72° 56′ E.*), the northern entrance point of Kumbaru bay, is a salient point, about 230 feet (70m1) high; the hills within this point are about 800 feet (243m8) high, and densely wooded. There is a conspicuous bluff about 2¼ miles eastward of the point.

Shah Jehan shoal, lying about three-quarters of a mile south-westward of Kumbaru point, has a least depth of 2¼ fathoms (4m1); the depths are irregular for a short distance westward of this shoal. A vessel in this vicinity should not proceed into depths of less than 6 fathoms (11m0).

Chart 400.

From Kumbaru point the coast is fringed by a reef and trends northward about 3½ miles to Rājpuri point, the southern entrance point of Janjira harbour, and on which stands a conspicuous lighthouse. Shoal water, with depths of less than 3 fathoms (5m5), extends about 9 cables offshore in places.

Chor Kassa or Whale reef, situated about 1¼ miles west-south-westward of Rājpuri point, dries 14 feet (4m3), and is covered by the *red* sector of Rājpuri Point light (*see* below), between the bearings of 057° and 075°. Shoal water, with depths of less than 3 fathoms (5m5), extends about 5 cables west-north-westward and 3½ cables southward from Chor Kassa.

Charts 2736, 826, 7482.

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Chart 400.

Rājpuri point is a cliffy wooded bluff, 228 feet (69m5) high; shoal water, with depths of less than 3 fathoms (5m5), extends about 8 cables westward and west-north-westward and about 3½ cables northward from this point.

A light is exhibited, at an elevation of 179 feet (54m6), from a white masonry tower, 34 feet (10m4) in height, situated near the western extremity of Rājpuri point.

Shoals, with least depths of 2½ fathoms (4m6) and 3 fathoms (5m5), lie about 9 cables north-westward and 8 cables northward, respectively, of Rājpuri Point light-structure.

Chart 738.

Caution.—*See* caution on page 219 regarding fishing stakes and logs.

Anchorages.—Srivardhan bay affords anchorage off the town, about 1½ miles offshore, in charted depths of about 4¼ fathoms (7m8). Local vessels call here regularly during the fine season.

A small vessel can obtain anchorage, with shelter from north-westerly winds, on the south-eastern side of Kumbaru point, in depths of from 2 to 3 fathoms (3m7 to 5m5).

Chart 400.

Janjira harbour.—Aspect.—Lights.—Janjira harbour, situated at the mouth of Rājpuri river, is approached between Rājpuri point and Yeoor point, about 4 miles north-north-westward. This harbour affords good shelter to a moderate-sized vessel from all winds, except those from north-west to west; small craft could proceed up Rājpuri river when it is blowing from the westward or north-westward.

The coast in the vicinity of Janjira harbour is hilly and fairly well wooded, with high ranges at the back of the coastal hills.

On the southern side of the entrance to the harbour is a peninsula with two conspicuous peaks; the southern one, Round hill, about 2½ miles south-south-eastward of Rājpuri Point lighthouse (*Lat. 18° 17′ N., Long. 72° 56′ E.*), is 751 feet (228m9) high and thickly wooded; Conical hill, the northern peak, about 7 cables north-north-westward of Round hill, is 754 feet (229m8) high and bare. Dighi hill, 808 feet (246m3) high, situated about 9 cables northward of Conical hill, is the highest point of the peninsula.

From Rājpuri point the southern shore of the bay curves gradually south-eastward for 1¾ miles, thence southward for about half a mile to the village of Dighi. Southward of Dighi there is a large bight fringed with mangroves, with a mud flat, which dries, occupying its entire area.

Janjira fort, about 2 miles north-eastward of Rājpuri Point lighthouse, is 125 feet (38m1) high and conspicuous; it is on a rocky islet lying about 2 cables offshore abreast the village of Rājpuri; the walls are about 50 feet (15m2) high.

A light is periodically exhibited, at an elevation of 132 feet (40m2), from a white wooden mast, 8 feet (2m4) in height, situated on Janjira fort.

Bandar hill, on the coast, about 6¾ cables north-north-westward of Janjira fort, is a small rounded headland, with a grassy summit, 231 feet (70m4) high; on its south-eastern side is a small stone pier used by local vessels during the fine season, from October to May.

A light is periodically exhibited, at an elevation of 261 feet (79m5), from a framework tower, 30 feet (9m1) in height, situated on the summit of Bandar hill.

Charts 738, 2736, 826, 748h.

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Chart 400.

Kansa fort is situated on a reef about 1¾ miles south-south-eastward of Yeoor point; the walls, which are partly in ruins, are about 20 feet (6m1) high.

A light is periodically exhibited, at an elevation of 32 feet (9m8), from a white iron structure, 12 feet (3m7) in height, on Kansa fort.

The Nawab's palace and flagstaff, which are conspicuous, stand on a steep bluff, 107 feet (32m6) high, about 1½ miles east-south-eastward of Yeoor point.

Yeoor point is low and rocky; Yeoor hill, about 8 cables northward of the southern extremity of Yeoor point (*Lat. 18° 21′ N., Long. 72° 55′ E.*), is 408 feet (124m4) high.

Murud hill, a conspicuous summit, 976 feet (297m5) high, is situated about 2½ miles east-north-eastward of Yeoor point.

Depths.—Dangers.—Apart from the dangers off Rājpuri point, the depths in the harbour and its approaches are from 3¼ to 4¼ fathoms (5m9 to 7m8). Rājpuri river has no bar but above Sandy point, about 2 miles south-eastward of Rājpuri village, the depths are less than 3 fathoms (5m5), and farther up the river it is shallow and only navigable by boats.

The shoals in the vicinity of Rājpuri point are described on page 225.

On the northern side of the harbour the coastal bank, with depths of less than 3 fathoms (5m5), extends from Sandy point north-westward to a position about 1½ miles westward of Janjira fort and thence northward to Yeoor point.

The reefs, on which stand Janjira and Kansa forts, lie on this bank; the coastal reef extends about 4½ cables southward from an unnamed point, about 8 cables east-south-eastward of Yeoor point.

Shoals, with depths of 3 fathoms (5m5), lie about 6½ cables southward and 2¾ cables south-westward, respectively, of Yeoor point.

Fishing stakes, consisting of large poles and sometimes of palm trees stripped of their leaves, are generally placed in certain positions within the harbour; as a rule they show well above high water.

Anchorages.—A vessel can obtain anchorage with Janjira fort bearing 001°, and the northern extremity of Rājpuri point (*Lat. 18° 17′ N., Long. 72° 56′ E.*) bearing 260°, in a depth of 3½ fathoms (6m4).

Better shelter can be obtained farther up the harbour with the eastern side of Janjira fort bearing 333°, and Sandy point bearing 100°, in a depth of 3¾ fathoms (6m9).

Tidal streams.—The tidal streams have a rate of from one to 1½ knots at springs.

Directions.—A vessel bound for Janjira harbour should not proceed into depths of less than 6 fathoms (11m0) until Janjira fort is identified. The fort should then be brought to bear 090°, and steered for on that bearing until Rājpuri Point lighthouse bears 180°; course should then be altered south-eastward into the harbour, or Sandy point steered for, bearing about 116°.

Storm signals.—Storm signals are displayed from Rājpuri Point lighthouse; the brief system is used. *See* page 20.

Murud.—Murud, situated on the north-eastern side of a creek on the north-eastern side of Bandar hill, is a town surrounded by a large grove of palm trees; this creek affords shelter to native trading and fishing craft.

Local vessels call daily.

Charts 738, 2736, 826, 748b.

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Chart 400.

Limited amounts of fresh provisions are obtainable.

Chart 738.

Coast.—Dangers.—From Yeoor point the coast trends north-north-westward for about 1½ miles to the southern entrance point of a shallow bay, at the head of which is the village of Nāndgaon; the bay is about 1¼ miles wide at its entrance.

Murud hill, 976 feet (297^{m}5) high, mentioned previously, about 2½ miles east-north-eastward of the southern extremity of Yeoor point, is thickly wooded and conspicuous.

From the northern entrance point of the bay described above the coast trends northward for about 9 miles to Korlai fort, the southern entrance point of Kundalika river. A dark cliff projects, from the southern end of a sandy beach, about 3¼ miles north-north-westward of Nāndgaon village.

Borlai, about 1¾ miles southward of Korlai fort, is a large fishing village. A short creek, with a bar across its mouth, leads to this village; native vessels of 9 feet (2^{m}7) draught can cross the bar at high-water springs during the fine season, but they more commonly anchor outside, where there is good holding ground.

Between Borlai and Korlai fort there are depths of less than 3 fathoms (5^{m}5) for a distance of about 3 miles offshore.

The coastal reef, which dries, fringes the greater part of this coast, extending a short distance offshore.

Caution.—*See* caution on page 219 regarding fishing stakes and logs.

Chart 738, with plan of Port Chaul.

Port Chaul.—Kundalika river is tolerably broad, and the tide flows over a considerable part of the low-lying land on either side at high-water springs. The estuary of the river is known as Port Chaul; it is only available to vessels able to cross the bar, over which there is a depth of about 7 feet (2^{m}1) in the fairway, but this probably is subject to change.

Local vessels call at Port Chaul.

Chart 738, plan of Port Chaul.

Aspect.—Light.—Korlai fort, on the southern side of the entrance, stands on the summit of a headland of a red colour, connected with the mainland by a low, narrow, sandy isthmus; the northern part of this headland slopes gradually to the coast, terminating in a rocky point. The village of Korlai (*Lat. 18° 32′ N., Long. 72° 55′ E.*) is situated at the head of the small bay on the eastern side of the isthmus.

A light is exhibited, at an elevation of 110 feet (33^{m}8), from a square masonry tower, 40 feet (12^{m}2) in height, situated in Korlai fort, about 2 cables southward of the northern extremity.

On the southern side of Kundalika river, about half a mile eastward of Korlai village, there is a range of wooded hills, culminating in Chaul knob, a round conspicuous summit, 834 feet (254^{m}2) high, about 1¼ miles eastward of the village.

Revadanda is a sixteenth-century Portuguese fortress on the northern entrance point of the river. The tower of the Franciscan convent, 100 feet (30^{m}5) high, is prominent above the fort walls.

The town of Chaul, a place of great antiquity, is situated on the northern bank of Kundalika river, close northward of Revadanda fortress.

Charts 2736, 826, 748b.

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Chart 738.

About 1½ miles north-eastward of Revadanda fortress is the temple of Hingladevi, which from its peculiar whiteness is conspicuous; on the summit of the 553-foot (168m5) hill above the temple stands Bhagat temple, also prominent. A Mohammadan tomb stands, at an elevation of 421 feet (128m3), about three-quarters of a mile north-westward of the latter temple; it is marked by a group of palm trees.

Dangers.—Beacon.—Buoy.—Chaul Kadu reefs, situated about 4½ miles north-westward of Korlai fort and about 2¾ miles offshore, are a group of rocky patches, with a least depth of 1¼ fathoms (2m3) over them; the sea breaks heavily over these reefs at low water. The north-eastern patch has on it a circular stone beacon, 20 feet (6m1) in diameter and 60 feet (18m3) high, with a refuge chamber, to which there is access by an iron ladder.

The *red* sector of Khānderi Island light, which is situated about 6¾ miles north-north-westward of Chaul Kadu beacon, covers these reefs between the bearings of 336° and 001°.

Chart 738, plan of Port Chaul.

Nine Feet patch, lying about 2¼ miles north-westward of Korlai fort (*Lat. 18° 32′ N., Long. 72° 54′ E.*), has a least depth of 9 feet (2m7); Six Feet patch, about 1¾ miles west-north-westward of the same fort, has a least depth of 6 feet (1m8), sand and rock.

Chaul bar, obstructing the entrance to Kundalika river, extends almost as far westward as Six Feet patch; Bar sand, the south-eastern extremity of which is situated about 5¾ cables west-north-westward of Korlai fort, has a least depth of 3 feet (0m9), sand and rock.

A black can buoy is moored off the south-eastern extremity of Bar sand.

The fairway over the bar lies on either side of Bar sand.

A shoal, with a depth of 6 feet (1m8), is situated on the northern side of the fairway, about 1½ miles west-north-westward of Revadanda fortress.

A sandy bank, the eastern side of which is about 2½ cables westward of Revadanda fortress, dries.

Anchorage.—A vessel can anchor, in depths of from 18 to 24 feet (5m5 to 7m3), off the landing place on the sandy point close east-south-eastward of Revadanda fortress.

Chart 738, with plan of Port Chaul.

Directions.—A small vessel entering Port Chaul, and coming from the southward, can pass between Korlai fort and Bar sand, by keeping the Mohammadan tomb bearing 046°.

A small vessel approaching from the northward can pass close north-eastward of Chaul Kadu beacon by steering with the centre of Korlai Fort headland bearing 139°. When Chaul knob bears 125°, a vessel should steer for it on this bearing, which leads over the bar between Bar sand and the 6-foot (1m8) shoal, 3½ cables north-eastward. Within the bar the depths quickly deepen to about 24 feet (7m3).

On the southern side of the entrance to Kundalika river there is usually a line of fishing stakes, which vessels can leave close south-westward. The edge of the sandbank westward of Revadanda fortress is generally marked by tide-rips.

Storm warnings.—Storm warnings are received at Revadanda but no signals are hoisted. *See* page 23.

Charts 2736, 826, 748b.

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Chart 738.

Coast.—Dangers.—Buoy.—Light.—From Revadanda fortress (*Lat. 18° 33′ N., Long. 72° 56′ E.*) the coast trends north-north-westward for about 5¾ miles to Akshi (Sakri), a village on the coast, on the southern side of the entrance to Alibāg creek, and consists of a sandy beach, bordered in some parts by groves of palm trees, which near Alibāg town are interspersed with jungle.

The dangers westward of Revadanda fortress, also Six Feet patch, Nine Feet patch and Chaul Kadu reefs, are described on page 228.

Paulo creek, the entrance to which is situated about 1¾ miles north-north-westward of Revadanda fortress, dries; native boats can proceed up this creek at high water to the fishing village of Theranpāda, about half a mile within its entrance.

Alibāg creek is about half a mile wide at its entrance between Akshi and Alibāg, a town built on the sandy point on the northern side of the entrance; it is almost choked with sand.

Alibāg, where there is a civil hospital, is completely hidden by groves of palm trees.

At low water a small stream winds past Alibāg, through the sandy bed, but at high water the creek presents the appearance of an extensive sheet of water, and during the rainy season is the outlet of water which inundates the low land at the foot of the Sagargarh range.

A spur of the Sagargarh range lies about 2 miles east-north-eastward of the town of Alibāg, and forms two narrow rocky ridges. Sagargarh, the highest peak of this range, is situated about 4¾ miles eastward of the town, and is 1,354 feet (412^{m}7) high; it is a round summit, faced on its southern side with prominent cliffs of considerable elevation; there is a sharp rocky peak close southward of Sagargarh peak. Farther southward the range is of less elevation, and is covered with jungle.

From Sagargarh peak the Sagargarh range trends in a north-westerly direction for about 5 miles, forming peaks of varied elevations.

At the north-western end of this range, about 2½ miles from the coast, there are three high, bare, prominent peaks, known as The Hummocks of Thāl; Parhur, the southernmost of these three, about 4 miles north-westward of Sagargarh peak, is a sharp conical-shaped peak, 1,021 feet (311^{m}2) high.

Kolāba fort, situated on a drying reef, on the north-western side of the entrance to Alibāg creek, about half a mile south-westward of Alibāg, is an ancient fortress; the pagoda-shaped cupola of the temple is prominent from seaward.

A light is periodically exhibited, at an elevation of 32 feet (9^{m}8), from Kolāba fort.

The fort is connected with the coast north-eastward by the reef on which it stands; this reef extends about half a mile south-south-westward from the fort. There are depths of less than 3 fathoms (5^{m}5) for the distance of about 3 miles south-westward and westward from the fort.

Alibāg Outer reef, situated about 1¼ miles westward of Kolāba fort, has a depth of one fathom (1^{m}8) over it; it is marked on its south-western side, during the fine season, by a red conical buoy. The reef is covered by the *red* sector of Khānderi Island light (page 233), between the bearings of 336° and 001°, but lies in the *white* sector of Kolāba Fort light, between the bearings of 070° and 145°.

From Alibāg the coast trends north-north-westward for about

Charts 2736, 826, 748b.

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Chart 738.

3½ miles to the northern end of Thāl, a village extending along the coast for about three-quarters of a mile; it consists of a low ridge of sandhills, inland of which are dense groves of palm trees.

The whole of this coast is fringed by sandbanks and reefs, extending in places about 1½ miles offshore; the inner reefs, which lie in narrow ridges parallel to the coast, are joined by low stone walls, and are used as fish traps. Depths of less than 3 fathoms (5^{m}5) extend about 3½ miles offshore.

Varsoli (Warsole) creek, the entrance to which is situated about 1½ miles north-north-westward of Alibāg, is a large creek, which can be entered by boats at high water. The village of Varsoli (Warsole) (*Lat. 18° 40′ N., Long. 72° 52′ E.*) lies on the south-eastern side of the entrance.

Khānderi island, described on page 233, lies about 3½ miles north-westward of the entrance to Varsoli creek.

Anchorage.—A small vessel of less than 9 feet (2^{m}7) draught may, on a rising tide, anchor off the entrance to Alibāg creek, tolerably close to the southern edge of the reef on which Kolāba fort stands. The southern patch of rocks is generally marked by a stake.

Storm signals.—Storm signals are displayed from Kolāba fort: the brief system is used. *See* page 20.

Cautions.—*See* caution on page 219 regarding fishing stakes and logs.

Vessels not bound for Alibāg should keep westward of the western limit of the sector of Khānderi Island light, in which it shows *red* between the bearings of 336° and 001°, covering Chaul Kadu and Alibāg Outer reefs.

Charts 2621, 737, 736.

APPROACHES TO BOMBAY HARBOUR.—Aspect.—Beacons.—Bombay harbour is approached between its south-eastern entrance point, about 6½ miles north-north-eastward of Khānderi island, and Colāba point, the southern extremity of Bombay island, 6½ miles north-north-westward. For radar range *see* Appendix III on page 346.

From the offing in clear weather the high peak of Bava Malang, about 32 miles north-eastward of Khānderi island, can be seen; the peak has an elevation of 2,588 feet (788^{m}8) and on its summit there is an enormous perpendicular cliff on which stands a ruined fort.

About 20 miles north-westward of Bava Malang is Kamandurg, a conical mountain 2,134 feet (650^{m}4) high, which is easily identifiable from seaward.

About 4½ miles north-north-westward of Kamandurg is the remarkable plateau of Tungar, about 2 miles long in a northerly and southerly direction, which attains an elevation of 2,165 feet (659^{m}9).

On nearer approach Kankeshwar and the Sagargarh range (page 229) on the southern side of the harbour, and Kanher and Shendur peaks on Salsette island on the northern side of the harbour, can be seen.

Kankeshwar (*Lat. 18° 45′ N., Long. 72° 55′ E.*), about 2¾ miles north-north-eastward of Parhur (page 229), is a mountain, 1,255 feet (382^{m}5) high; this mountain is separated by the valley of Pen (Ambā) river from a range of thickly wooded hills which extends along the south-eastern side of the entrance to Bombay harbour.

Charts 2736, 826, 748b.

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Charts 2621, 737, 738.

The mountain range on Salsette island has several remarkable peaks; the central and highest is Kanher, which is 1,508 feet (459m6) high and lies about 16 miles west-north-westward of Bava Malang; when seen from westward it appears to have a flat summit. Shendur, the northern peak on the island, lies about 3 miles north-north-eastward of Kanher; it is a sharp detached peak, 1,500 feet (457m2) high.

Trombay island (page 242), lying close eastward of the northern end of Bombay island, rises to an elevation of 988 feet (301m1) at Trombay peak. On its southern side there are several oil refinery chimneys, the flares from which are conspicuous and visible from seaward.

Chart 2621.

Thāl knob, a hill 178 feet (54m2) high, about 7 cables east-south-eastward of the south-eastern entrance point of Bombay harbour and about 1¾ cables from the coast, has on its summit a conspicuous white beacon, 60 feet (18m3) in height (*see* view on chart). False knob, about 5 cables south-south-westward of Thāl knob, is similar in appearance, but rather lower; in thick weather these hills stand out well among the coconut trees, being detached from the more distant high land.

Ashuerra hill, 876 feet (267m0) high, about 3½ miles east-south-eastward of Thāl knob, has two hummocks named The Paps; on the northern hummock there is a conspicuous black beacon, 80 feet (24m4) in height (*see* view on chart), known as North Pap beacon.

Kansa islet, 20 feet (6m1) high, situated about 2 miles north-north-eastward of Thāl knob on the southern side of the entrance to Dharamtar creek (page 248), has on its summit a beacon, 67 feet (20m4) in height, consisting of a steel column surmounted by a barrel.

Karanja hill, 991 feet (302m1) high, at the southern end of Karanja island, about 2¾ miles east-north-eastward of Kansa islet, is a long flat-topped hill; the southern side of this hill is steep and almost inaccessible, but the northern part slopes gradually from its summit to a shoulder on which is a ruin.

Khāravi hill, 696 feet (212m1) high, at the northern end of Karanja island, about 2¾ miles north-north-westward of Karanja hill, is formed by four ridges meeting, and has a very sharp summit.

Bombay island, on which stands the city of Bombay, lies on the northern side of the harbour entrance and consists of a low-lying plain flanked by two parallel ridges of low hills. The fort on Worli point, the north-western extremity of the island, is a good mark from seaward. For other conspicuous objects *see* page 247. For radar range *see* Appendix III on page 346.

Chart 2736.

Outlying banks.—The Fifty Fathoms flat, lying between 60 and 120 miles westward of Bombay (*Lat. 18° 57′ N., Long. 72° 49′ E.*), is an extensive flat, with depths of from 45 to 50 fathoms (82m3 to 91m4), fine sand, although muddy bottom has occasionally been found in the space between this flat and Direction bank.

Direction bank, the northern end of which is situated about 39 miles west-south-westward of the south-eastern entrance point of Bombay harbour, extends for about 27 miles in a southerly direction, and has depths of from 20 to 35 fathoms (36m6 to 64m0), coarse sand and small shells; eastward of this bank the depths decrease gradually from about 30 fathoms (54m9), off its eastern edge, towards the coast.

Charts 826, 748b.

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Chart 2736.

When approaching this bank from the westward a vessel will pass over The Fifty Fathoms flat, then gradually shoal to depths of 40 fathoms (73m2), and then suddenly to depths of 30 and 23 fathoms (54m9 and 42m1) over Direction bank; after this it deepens again to over 30 fathoms (54m9) over the greater part of the bank, and to about 27 fathoms (49m4) at its southern end.

When approaching Bombay from the south-westward, if the vessel be southward of Direction bank the depths will decrease rapidly from 40 to 30 fathoms (73m2 to 54m9), and continue between 30 and 20 fathoms (54m9 and 36m6) for some distance, until the latter depth is obtained about 17 miles offshore.

If northward of Direction bank a vessel will run a considerable distance before the depth alters from 40 to 30 fathoms (73m2 to 54m9), but the depths will then rapidly decrease to 20 fathoms (36m6), which depth is about 15 miles westward of Khānderi island (page 233) or Prongs Reef lighthouse, which is situated about 10½ miles northward of Khānderi island (*Lat. 18° 42′ N., Long. 72° 49′ E.*).

Chart 737.

Submarine exercise area.—A rectangular submarine exercise area, indicated on the chart, lies in the north-western approach to Bombay; the centre of the area is about 23½ miles west-north-westward of Malabar point (page 235). *See* Admiralty Notice to Mariners No. 8 of each year.

Fishing stakes.—In the approach to Bombay, either from the northward or southward, lines of strong fishing stakes surmounted by baskets, which project about 20 feet (6m1) out of the water, may be met with anywhere when in depths up to 10 fathoms (18m3) and sometimes up to 12 fathoms (21m9).

In the immediate approach to the harbour, within the area shown by pecked lines on the charts, no fishing stakes are permitted, but even within this area they are sometimes placed, and so may be met with before the port authorities have been able to effect their removal.

Occasionally the heads of the stakes are broken off, and then they may not be visible above water.

Pilotage.—Pilotage is compulsory for all power-driven merchant vessels of over 200 tons and sailing vessels of over 350 tons northward of a line drawn in an easterly and westerly direction through Prongs Reef lighthouse (page 235). Such vessels are prohibited from entering, leaving or shifting berth in the area of the port northward of this line without a pilot or harbour official on board.

Licensed pilots may be obtained from the steam pilot vessel, painted white, with the word "PILOT" in black letters on each side of the hull, having a yellow funnel with a black top, which cruises in an approximate position latitude 18° 51′ N., longitude 72° 50′ E. By day she displays the pilot flag, and at night the customary lights for a steam pilot vessel are exhibited.

For directions for a vessel awaiting a pilot, *see* page 247.

The pilot vessel is fitted with radio for communicating with vessels entering or leaving the harbour. Vessels should inform the pilot vessel by radio of their time of arrival and any subsequent amendment at least 24 hours before their arrival. *See* Admiralty list of Radio Signals.

A copy of the "Bombay port rules" will be handed to the master of a vessel by the pilot on arrival on board.

Charts 826, 748b.

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Chart 2621.

Regulations.—Signals.—The following are extracts from the "Bombay port rules":—

(12) The pilot jack is hoisted at the port signal station (page 244) when the pilot vessel is absent from her station.

The following signals should be made to Prongs Reef lighthouse (page 235):—

(22) Vessels liable to quarantine shall display the appropriate quarantine signals given in the International Code of Signals, and signal the name by Morse code on the whistle if the weather is thick to attract attention; or, at night, three lights at a height of not less than 20 feet (6^m1) above the hull of the vessel, which shall be arranged at a distance of not less than 6 feet (1^m8) apart in the form of an equilateral triangle; the light at the apex of the triangle shall be *white* and the lights at the ends of the base shall be *red*; to be hoisted irrespective of any particular mast. The signal to remain hoisted until the port health officer grants permission for it to be hauled down.

(23) Vessels carrying explosives shall hoist a red flag at the fore by day, or a *red* light at the fore at night, to remain hoisted until the explosives have been discharged.

(24) Vessels carrying petroleum in bulk shall hoist a red flag at the fore and the International Code signal RKO by day, or a *red* light at the fore at night, to remain hoisted until the vessel receives certificate from qualified surveyor.

(33) Vessels flying special signals by day are answered by Prongs Reef lighthouse hoisting a corresponding signal.

(34) Vessels not flying special signals are, by day, answered by Prongs Reef lighthouse (*Lat. 18° 53′ N., Long. 72° 48′ E.*) hoisting the answering pendant.

All vessels having on board petroleum or vapour of petroleum, and tugs towing or attending such vessels, shall display from sunrise to sunset a red square flag with a white round centre in the case of dangerous petroleum, or a red square flag in the case of non-dangerous petroleum.

Charts 2621, 738.

Coast. — Lights. — Radiobeacon. — Dangers. — Beacon. — Buoyage.—Light-vessel.—From Thāl village (page 230) the coast trends northward for about $6\frac{1}{4}$ miles to the south-eastern entrance point of Bombay harbour; foul ground and shoals extend in places about 3 miles offshore.

Chart 2621.

Khānderi island, lying about $2\frac{1}{2}$ miles offshore, has two hills, on the southern and higher of which stands the lighthouse, with a flagstaff north-eastward of it; the island, which is sparsely covered with trees and scrub, is surrounded by the remains of a wall. There is a good landing place in a bight on its north-eastern side.

A light is exhibited, at an elevation of 154 feet (46^m9), from an octagonal tower surmounting a flat-roofed house, 100 feet (30^m5) in height, situated on the summit of Khānderi island. *See* view [18]. It is connected by telephone with Bombay. A radiobeacon transmits from this lighthouse.

If a vessel is seen to be standing into danger a warning rocket signal

Charts 2736, 826, 748b.

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Chart 2621.

is fired and the International Code signal "You are standing into danger" is displayed.

A reef, awash at its centre, lies with its southern end about 2 cables eastward of Khānderi island; a black beacon, 31 feet (9m4) high, stands near its northern end. It is generally smooth around this reef.

A rock, which dries 14 feet (4m3), is situated about 2½ cables north-eastward of the northern extremity of Khānderi island.

Charts 2621, 738.

Underi islet, lying about 1½ miles eastward of Khānderi island and about one mile offshore, is low, dark and rocky, and has ruined fortifications all round it; within the fort, the entrance to which is on the eastern side, there are a few trees.

Rocks, which dry, extend about 3½ cables southward from Underi islet, leaving a very narrow channel between them and the reefs which extend westward from the coast; an island lies about one cable westward of Underi islet, and for a distance of about 4 cables farther westward the ground is rocky and uneven.

The channel between Khānderi island (*Lat. 18° 42′ N., Long. 72° 49′ E.*) and Underi islet should only be used by small vessels having local knowledge.

Chart 2621.

Thāl reefs, the southern end of which is situated about 3½ miles northward of Underi islet, extend about 3 miles in a north-north-easterly direction, and consist of numerous reefs and rocks, which extend up to about 1½ miles offshore. Several detached shoals, with depths of from 13 to 18 feet (4m0 to 5m5), lie within a distance of one mile westward of the western edge of Thāl reefs.

The northern extremity of Kansa islet (page 231) in line with Karanja hill (page 231), bearing 061°, leads close north-westward of the northern end of Thāl reefs.

Thāl shoal, lying about 5¾ miles northward of Khānderi island and about 2½ miles offshore, is composed of sand and rock, with several detached heads, having a least depth of 14 feet (4m3). A black conical buoy is moored off the north-western side of the shoal about 2 cables north-westward of the north-western shoal head.

The *red* sector of Sunk Rock light (page 237), between the bearings of 209° and 015°, covers Thāl reefs and Thāl shoal.

A black conical light-buoy, exhibiting a *white flashing* light *every three seconds*, is moored about 1½ miles northward of Thāl shoal. This light-buoy marks the southern side of the main fairway into Bombay harbour.

Malabar point (page 235) in line with Prongs Reef lighthouse (page 235), bearing 353°, leads westward of Thāl shoal.

Thāl Knob beacon in line with North Pap beacon (page 231), bearing 121°, leads north-eastward of Thāl shoal. *See* view on chart.

East Channel swatch, the channel between the south-eastern side of Thāl shoal and the detached shoals westward of Thāl reefs, has a least charted depth of 19 feet (5m8).

Colāba, on the north-western side of the entrance to Bombay harbour, is the narrow peninsula extending south-westward from Bombay island; it is covered with buildings. For conspicuous objects, *see* page 248.

Prongs reef, which dries, extends about 2 miles south-south-westward

Charts 2736, 826, 748b.

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Chart 2621.

from Colāba point, the southern extremity of Colāba peninsula. Prongs Reef lighthouse stands on the reef about one mile south-south-westward of the point. Foul ground extends about one mile south-westward, south-eastward and eastward from the lighthouse. The *red* sector of Sunk Rock light (page 237), between the bearings of 031° and 069°, covers this foul area.

A light is exhibited, at an elevation of 139 feet (41m4), from a round tower, 172 feet (52m4) in height, painted with red, white and black in horizontal bands, situated on Prongs reef. *See* view [19]. Vessels signalling to this lighthouse are reported by telephone to Bombay. For radar range *see* Appendix III on page 346.

Thāl Knob beacon in line with North Pap beacon, bearing 121°, leads south-westward of the foul ground southward of Prongs Reef lighthouse (*Lat 18° 53′ N., Long. 72° 48′ E.*). *See* view on chart.

A red can light-buoy, exhibiting a *red flashing* light *every one and a half seconds*, is moored off the above foul area about 1½ miles south-eastward of Prongs Reef lighthouse. This light-buoy marks the northern side of the main fairway into Bombay harbour.

A light-vessel, fitted with a radar reflector, is moored off the entrance of the harbour, about 4¼ miles south-westward of Prongs Reef lighthouse; it exhibits a light at an elevation of 32 feet (9m8). The hull is painted red and marked "Bombay Floating Light" on its sides.

Back bay is the bight formed by the coastline between Colāba point and Malabar point, about 3 miles north-north-westward; it is encumbered with rocks and reefs and only used by local craft.

Reefs, which dry, extend about one mile offshore on the western side of Colāba peninsula.

Eight Feet patch, the westernmost danger in the southern approach to Back bay, is situated about 1¾ miles west-north-westward of Colāba point and has a least depth of 9 feet (2m7) over it; Khānderi Island lighthouse, bearing less than 166°, leads well westward of this patch.

Close northward of Eight Feet patch is a long narrow reef, which dries in its northern part and extends north-north-eastward to within about 3½ cables of Malabar point.

Malabar point (*Lat. 18° 56′ N., Long. 72° 48′ E.*) lies at the southern extremity of the western ridge of low hills on Bombay island; a flagstaff, 174 feet (53m0) high, stands on the point. For radar range *see* Appendix III on page 346.

From Malabar point the west coast of Bombay island trends about 5½ miles north-north-eastward to Worli point; it is fringed by a drying reef and shoal water, with depths of less than 3 fathoms (5m5), extending about half a mile off the southern part and up to one mile off the northern part. *See* view on chart 737.

A fort in ruins stands about one quarter of a mile within Worli point; a conspicuous tower is situated about half a mile southward of the fort.

Prohibited anchorage.—Anchorage eastward of Khānderi island is prohibited in the area indicated on the chart.

Submarine cables.—Vessels are warned not to anchor in Back bay, in the area indicated on the chart, on account of the existence of several submarine cables.

Tidal streams.—The rate and direction of the tidal streams in the approaches to Bombay are generally as described below, but they are much influenced by winds and heavy rains.

Charts 737, 2736, 826, 748b.

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Chart 2621.

Between Thāl shoal and a position about 4 miles west-north-westward the flood stream sets between east-south-east and east-north-east, taking a more northerly direction as the rate increases. In East Channel swatch it sets in about a north-north-easterly direction, taking a more easterly direction as it crosses the mouth of Dharamtar creek, which is entered northward of Kansa islet.

Off the south-western extremity of Prongs reef the flood stream at first sets in an east-south-easterly direction, but as the rate increases it changes to the north-eastward; eastward of the reef, as far as Sunk rock, it sets between north-north-east and north by east.

On the southern side of the entrance to the harbour the ebb stream sets in a west-south-westerly direction across the entrance to Dharamtar creek, altering to between south-west and south-south-west on nearing Thāl shoal, and more southward as it goes south. Between Thāl shoal and a position about 4 miles west-north-westward it sets about south-west by west.

On the northern side of the entrance the ebb stream sets in a south-westerly direction from Sunk rock to abreast Prongs Reef lighthouse, where it sets between west by north and west by south, changing to about south-south-west as the tide strengthens.

The tide does not set fairly through the channel, but the flood stream sweeps eastward over the foul ground of Thāl shoal. During rains in the south-west monsoon the ebb sets strongly in a westerly direction out of Dharamtar creek. *See* also page 248.

The rate of strong spring tides between Thāl shoal and Prongs reef is from 2½ to 3 knots, and perhaps as much as 4 knots during the rains.

Directions.—*See* page 247.

BOMBAY HARBOUR.—Bombay harbour contains several islands, rocks and shoals, and its shores are indented by bays and inlets.

The direction and management of the port, pilotage, the berthing and docking of vessels, and docks under the control of the trustees of the port, are vested in the Deputy Conservator.

Thāna creek flows into the head of Bombay harbour, on the eastern side of Trombay island; Panvel river flows into the harbour on its south-eastern side, northward of Hog island, about 9½ miles east-north-eastward of Colāba point (*Lat. 18° 54′ N., Long. 72° 49′ E.*).

Port limits.—The limits of the port of Bombay are shown on the chart. The western limit extends from Malabar point to a position 7 miles south-westward of it and thence to Khānderi island.

Depths.—There is a least depth of 30 feet (9^{m}1) in the fairway of the entrance to Bombay harbour until abreast Sunk Rock lighthouse (page 237).

Islets and dangers.—Beacons.—Buoyage.—Lights.—Thāl reefs and Thāl shoal on the south-eastern side of the harbour entrance are described on page 234.

A bank, with depths of less than 3 fathoms (5^{m}5), fills the south-eastern part of Bombay harbour between the south-eastern entrance point and Karanja reefs, about 4 miles northward. Kansa islet (page 231) lies on this bank.

Foul ground extends about 2 cables eastward from Kansa islet and a reef, which dries 4 feet (1^{m}2), lies about 1½ cables south-south-eastward of the islet.

Charts 737, 2736, 826, 748b.

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Chart 2621.

A black conical buoy is moored about 3½ miles north-north-westward of the south-eastern entrance point of the harbour; it marks the north-western corner of the outlying fishing areas in the entrance to the harbour; this buoy is withdrawn during the south-west monsoon.

Charts 655, 2621.

Karanja reefs extend about 2 miles off the western side of Karanja island. The parts, which dry, extend but a short distance offshore and are composed of trap rock, covered with loose boulders and enclose fishponds. The remainder of the reefs have depths of less than 3 fathoms (5^{m}5) over them with patches with depths of less than 6 feet (1^{m}8). The spoil grounds on Karanja reefs together with the buoys marking them are described on page 242.

Karanja beacon, consisting of a black steel structure, 28 feet (8^{m}5) in height, surmounted by a cone, stands near the north-western end of Karanja reefs about 6¾ miles northward of Kansa islet.

South Karanja black conical buoy is moored off the south-western side of Karanja reefs about 3 miles north-westward of Kansa islet.

A red conical fishing buoy lies about half a mile westward of Karanja beacon (*Lat. 18° 55′ N., Long. 72° 53′ E.*).

North Karanja black conical light-buoy, exhibiting a *white group flashing* light having *three flashes every ten seconds*, is moored about 4 cables north-westward of Karanja beacon. This light-buoy marks the south-eastern side of the channel leading to Butcher island and Thāna creek (page 249).

Chart 2621.

On the north-western side of the harbour entrance Prongs reef and the foul ground in that vicinity are described on page 234.

Colāba shoals lie off the eastern side of Prongs reef and the southern part of Colāba peninsula; there are depths of less than 6 feet (1^{m}8) over them and they extend in places to about one mile off the reef and peninsula.

Sunk rock lies about 1¼ miles east-south-eastward of Colāba point; it is awash and marked by a lighthouse. The fairway lies eastward of this rock.

A light is exhibited, at an elevation of 65 feet (19^{m}8), from a round tower, 91 feet (27^{m}7) in height, situated on Sunk rock. *See* view [20].

Chart 655.

Oyster rock lies on the eastern edge of Colāba shoals about 8 cables north-north-westward of Sunk rock; it is flat, about 70 feet (21^{m}3) high, and a tower, with an elevation of 92 feet (28^{m}0), stands on it. A reef, which dries, extends about one cable south-south-westward from the rock and foul ground extends a further 1½ cables in the same direction; the foul ground, with a least depth of one foot (0^{m}3), is known as Nigger's head.

Fishing stakes extend about half a mile east-south-eastward from Oyster rock (*Lat. 18° 54′ N., Long. 72° 50′ E.*); care is necessary when navigating in this vicinity, as the stakes are often broken off just below water.

Dolphin rock lies about 8 cables north-eastward of Oyster rock; it is marked by a lighthouse and is nearly steep-to on its eastern side.

A light is exhibited, at an elevation of 35 feet (10^{m}7), from a grey masonry tower with a white dome, 58 feet (17^{m}7) in height, situated on Dolphin rock.

Charts 737, 2736, 826, 748b.

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Chart 655.

Colāba reef, which dries 4 feet (1m2), lies on foul ground which extends westward from Dolphin rock to the shore and south-westward for about half a mile. North beacon, consisting of a cylindrical stone structure, 17 feet (5m2) in height and painted black and white in bands, stands about half a cable northward of the northern extremity of Colāba reef and about 2 cables westward of Dolphin rock. South beacon, 22 feet (6m7) high and similar in colour but slightly different in shape from North beacon, stands on the south-western extremity of the foul ground about 3½ cables south-westward of North beacon.

Middle Ground islet, situated about 7 cables east-north-eastward of Dolphin rock, is a rocky islet, about 40 feet (12m2) high, on which two towers stand at an elevation of 56 feet (17m1).

A shoal, with a least depth of 8 feet (2m4), extends about 1¾ cables north-north-eastward from the islet, and there is a 3-fathom (5m5) patch close off the northern end of the shoal.

A spherical light-buoy, painted red and white in bands and exhibiting a *red flashing* light *every one and a half seconds*, is moored on the northern extremity of the shoal described above.

Shoal ground extends about half a cable south-westward from Middle Ground islet.

The 119-foot (36m3) spire of the Scottish church, about 9 cables west-north-westward of Middle Ground islet, in line with Rajabaee clock tower (*Lat. 18° 56′ N., Long. 72° 50′ E.*), about 2¾ cables north-westward of the church, bearing 307½°, leads south-westward, and the same clock tower, bearing 291°, leads northward of the shoals off Middle Ground islet.

The Naval dockyard, Breakwater pier and Ballard pier lie about three-quarters of a mile north-westward of Middle Ground islet. The entrance to Alexandra dock (page 244) lies at the northern end of the eastern side of Ballard pier.

Cross Island reef, consisting of three detached reefs, which dry 4 feet (1m2), lies with its southern extremity about one mile northward of Middle Ground islet. A red stone cylindrical beacon, 13 feet (4m0) high, stands on the eastern reef. Another beacon, 17 feet (5m2) high, stands on the western edge of the western reef about 2¾ cables northward of the southern extremity.

"M" can light-buoy, painted black and white in horizontal bands and exhibiting a *white flashing* light *every four seconds* is moored off the southern end of Cross Island reef; it marks the northern side of the approach channel to Alexandra dock.

The northern end of Cross Island reef is marked by a white can buoy.

Three red can buoys are moored about 2½ cables south-south-eastward, 2 cables eastward and 3 cables east-north-eastward, respectively, of the eastern beacon on Cross Island reef; they mark the approximate position of the 3-fathom (5m5) line off Cross Island reef. Two white conical buoys, the northern of which has a spherical top-mark, lie about 3¼ cables south-eastward and 5¼ cables east-north-eastward, respectively, of the same beacon.

Cross island, 64 feet (19m5) high, is situated about 1¾ miles northward of Middle Ground islet; a reef, which dries 3 feet (0m9), extends about 1¾ cables west-south-westward and half a cable northward from the island. Several patches, which dry, lie between the south-western

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Chart 655.

extremity of the reef and the shore; the southern edge of these patches is marked by a red conical buoy.

A small detached reef, which dries one foot (0m3), lies about one cable northward of Cross island.

North Channel beacon (*Lat. 18° 57′ N., Long. 72° 51′ E.*), a cylindrical structure 28 feet (8m5) in height, and painted red and white in horizontal bands, stands on a bank, with general depths of from one to 3 feet (0m3 to 0m9), about 2 cables northward of Cross island. A light is exhibited, at an elevation of 19 feet (5m8), from this beacon.

A red mooring buoy lies about 2 cables eastward of Cross island.

The entrances to Victoria and Prince's docks (page 245) lie westward of North Channel light-beacon; the southern side of the approach channel to these docks lies about half a cable northward of the light-beacon.

Malet shelf, a rocky patch which dries 4 feet (1m2), lies about 4 cables north-north-westward of North Channel light-beacon and about half a cable offshore; it is marked by a beacon, 14 feet (4m3) high, surmounted by an iron drum. A patch, which dries one foot (0m3), lies about 2 cables southward of Malet shelf; this patch lies near the northern edge of the approach channel to Victoria and Prince's docks.

Three red and white chequered mooring buoys lie about 3 cables south-eastward, 6 cables east-south-eastward and 5¾ cables east-north-eastward, respectively, of Malet Shelf beacon.

Shoal water, with depths of less than 12 feet (3m7), extends up to half a mile offshore abreast Malet Shelf and up to about one mile offshore further northward.

Charts 655, 2621.

From a position about 7 cables eastward of North Channel light-beacon a channel, with a depth of 12 feet (3m7), leads north-eastward to Pir Pau deep (page 242), passing westward of Butcher Big reef.

The north-western part of the harbour is filled by coastal bank, with depths of less than 3 fathoms (5m5), which forms the northern side of the channel to Butcher island and Thāna creek.

Tucker beacon, a cylindrical structure painted red and white in horizontal bands and from which a light is exhibited, at an elevation of 48 feet (14m6), stands on the southern edge of this bank, about 1½ miles south-eastward of Cross island. *See* view [21].

North Tucker beacon, about 2½ cables north-north-westward of Tucker light-beacon, is erected on a pile of rubble which dries 7 feet (2m1); it consists of an iron framework structure, surmounted by a triangle, the apex of which is 19 feet (5m8) high.

A 2-foot (0m6) shoal lies about 5½ cables north-westward of North Tucker beacon.

Chart 2621.

Butcher island, 67 feet (20m4) high, lies about 2¼ miles north-eastward of Tucker light-beacon; a conspicuous water tank stands near the centre of the island and there is a prominent flagstaff on the south-eastern side of the island. A concrete oil jetty (page 246) extends from the south-eastern side of the island; there is a small pier close northward of it.

Reefs, which dry 10 feet (3m0), extend about 1½ cables north-westward from the island; foul ground also extends about one mile south-westward, three-quarters of a mile north-north-westward and half a

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Chart 2621.

mile north-eastward from the island; the reef extending south-westward terminates in a rock, with a depth of less than 6 feet (1m8) over it, in a position about one mile south-south-westward of the flagstaff on Butcher island.

Butcher rock, about 6 cables southward of Butcher island (*Lat. 18° 58′ N., Long. 72° 54′ E.*), is steep-to on its southern and eastern sides; it is marked by a red stone beacon, 25 feet (7m6) high, from which a light is exhibited at an elevation of 30 feet (9m1). *See* view [22].

A breakwater, which is 10 feet (3m0) above chart datum and uncovers at about half tide, extends north-north-westward from Butcher rock to the reef extending south-westward from Butcher island.

Leading lights are exhibited from the eastern side of Butcher island; in line, bearing 255°, they lead to the small pier.

Butcher Big reef, which dries 5 feet (1m5), lies on the coastal bank which fills the northern part of the harbour; it extends about 6½ cables southward from a position three-quarters of a mile west-north-westward of the northern extremity of Butcher island; it lies on an extensive shoal, with depths of less than 6 feet (1m8), which extends about 2½ cables north-eastward, 1½ cables eastward and westward and 8½ cables south-south-westward from the reef. Three patches, each with a depth of 5 feet (1m5), lie between a quarter and half a mile westward of the southern end of the reef.

Two black conical buoys are moored about 4 cables west-north-westward and 9 cables north-north-eastward, respectively, of the northern extremity of Butcher Big reef.

Uran shoal, situated on the south-eastern side of the channel to Thāna creek about 1½ miles east-south-eastward of Tucker light-beacon and the same distance offshore, dries 2 feet (0m6); it is marked by Uran beacon, a black circular stone structure, 28 feet (8m5) high, from which a light is exhibited at an elevation of 39 feet (11m9). *See* view [23].

The spoil grounds on Uran shoal, together with the buoys marking them, are described on page 242.

Uran Patch beacon, a black circular structure, from which a light is exhibited at an elevation of 22 feet (6m7), stands about half a mile north-eastward of Uran light-beacon; these two light-beacons, in line bearing 203°, lead through the channel eastward of Butcher island and Butcher rock.

West Uran black conical light-buoy, exhibiting a *white flashing* light *every four seconds*, is moored 5½ cables westward of Uran light-beacon (*Lat. 18° 56′ N., Long. 72° 54′ E.*).

South West Elephanta black conical light-buoy, exhibiting a *white group flashing* light having *three flashes every ten seconds*, is moored about three-quarters of a mile north-eastward of Uran Patch light-beacon.

These two light-buoys mark the south-eastern side of the channel to Thāna creek.

Elephanta island, 553 feet (168m5) high, lies on the coastal bank on the eastern side of the channel to Thāna creek, about 1¾ miles north-eastward of Uran Patch light-beacon. It is wooded, with two hills separated by a deep ravine; in the south-western hill are the celebrated caves.

A pier, which is used for visiting the caves, extends from the north-

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Chart 2621.

western side of the island, but it partly covers at high water; the end of the pier is marked by Elephanta beacon B, an iron tripod surmounted by a black cage, 12 feet (3m7) high. There is another pier on the north-east coast about 3½ cables from the northern end of the island, but it has fallen into disuse. The best landing place is at a new pier on the south-east coast about 2 cables northward of the southern extremity of the island.

A beacon, 30 feet (9m1) in height, consisting of a steel column surmounted by a barrel, stands near the northern end of the island; the topmark has an elevation of 135 feet (41m1).

Leading lights, about 1½ cables apart, are exhibited from the reef off the south-western side of Elephanta island; in line, bearing 060°, they lead through the south-western approach to the channel between Butcher and Elephanta islands.

West Elephanta black conical buoy is moored near the eastern side of the channel about 4 cables westward of the western extremity of Elephanta island.

Elephanta Patch beacon, from which a light is exhibited at an elevation of 22 feet (6m7), stands about half a mile north-westward of Elephanta island. A black conical buoy is moored about 1½ cables west-north-westward of the beacon; between the buoy and the beacon there is a 19-foot (5m8) patch.

Sheva rock (*Lat. 18° 56′ N., Long. 72° 56′ E.*), a drying reef lying about 6½ cables south-south-eastward of the southern point of Elephanta island and about 2¾ cables offshore, abreast the village of Sheva, is marked by a black masonry pillar, surmounted by a pole and ball, 32 feet (9m8) high.

Elephanta rock, about 1¾ cables south-westward of the southern end of Elephanta island, has a depth of less than 6 feet (1m8) over it.

Barnacle rock, about 2 cables east-south-eastward of the eastern extremity of Elephanta island, dries one foot (0m3); it is marked by a red pillar-beacon, 30 feet (9m1) high.

Elephanta spit extends about one mile north-eastward from the north-eastern end of Elephanta island and dries; it is marked on the western side of its north-eastern end by a conical buoy, painted black and white in horizontal bands, and surmounted by a triangle.

Charts 2621, 737.

The channel between Elephanta and Butcher islands is used by vessels proceeding to Pir Pau wharf (page 246) and by small craft bound for Thāna, a town on the western side of Thāna creek, about 14 miles northward of Elephanta island. It carries a least depth in the fairway of 29 feet (8m8) to abreast Elephanta Patch light-beacon and 19 feet (5m8) from thence to the entrance to Pir Pau deep (page 242); northward of that it is shallower and vessels drawing more than 18 feet (5m5) should not proceed further.

Hog island lies on the southern side of the entrance to Panvel creek (page 249), about 8 cables eastward of the northern part of Elephanta island.

Chart 2621.

A beacon, 46 feet (14m0) high, consisting of a steel column surmounted by a barrel, stands on the reef extending a short distance from the north-western point of Hog island. A white pillar stands close south-eastward of the beacon.

Charts 737, 2736, 826, 748b.

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Chart 2621.

The channel on the eastern side of Elephanta island is moderately deep, but a vessel approaching from the westward on the leading marks shown on the chart, viz., Butcher Rock light-beacon in line with the northern end of Cross island, bearing 271°, will pass southward of Elephanta island in a least charted depth of 11 feet (3^{m}4); there are depths of only 9 to 11 feet (2^{m}7 to 3^{m}4) at the outlet at the northern end of this channel.

Trombay island (page 231) lies on the northern side of the harbour with its southern extremity about 2 miles north-westward of Elephanta island. It is separated from Bombay island, westward, by Sewri creek, the southern entrance to which is filled by a drying bank known as Sewri Mud flat.

Pir Pau tomb (*Lat. 19° 00′ N., Long. 72° 55′ E.*), a small but conspicuous mosque with a white dome, 74 feet (22^{m}6) high, stands on the southern extremity of Trombay island. Another white dome and a chimney, both conspicuous, stand at elevations of 142 and 410 feet (33^{m}3 and 125^{m}0), respectively, about half a mile north-eastward of Pir Pau tomb.

Pir Pau bulk oil jetties (page 246) extend from the southern side of Trombay island; they consist of three jetties, each with a T-shaped head.

The jetties are approached from the channel to Thāna creek through Pir Pau deep, which is dredged to a depth of 18 feet (5^{m}5). The deep is marked on its northern side by Nos. 1, 3 and 5 conical buoys each surmounted by a triangle; Nos. 1 and 5 buoys are painted black and No. 3 buoy is painted black and white in chequers. The southern side of the channel is marked by Nos. 2 and 4 can buoys; No. 2 buoy is painted red and No. 4 buoy red and white in vertical stripes.

Green island lies at the southern end of a drying reef, which extends about 8 cables south-south-westward from the south-western extremity of Trombay island; a beacon, 39 feet (11^{m}9) high and consisting of a column surmounted by a disc, stands on Green island. A black conical buoy is moored about 1¼ cables south-south-eastward of the island.

Red obstruction lights are exhibited from each of the radio masts at Mahul, about one mile north-north-eastward of Green island; one pair at an elevation of 319 feet (97^{m}2) and the other pair at 315 feet (96^{m}0).

A light is exhibited, at an elevation of 988 feet (301^{m}1), from the summit of Trombay peak, about 3 miles north-eastward of Green island.

Spoil grounds.—Buoyage.—A rectangular spoil ground is centred about 2¼ miles south-south-westward of Karanja beacon as indicated on the chart; a conical light-buoy, painted black and yellow in vertical stripes and exhibiting a *white flashing* light *every second*, is moored near the middle of the northern side of the area; a spherical buoy of similar colour, surmounted by a black conical topmark, is moored near the middle of the eastern side.

Between the above-mentioned spoil ground and Karanja beacon there are five disused spoil grounds, as indicated on the chart.

Uran spoil ground lies on the north-western side of Uran light-beacon; it is triangular in shape with the light-beacon at the apex and a conical buoy, painted black and yellow in horizontal bands and

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Chart 2621.

surmounted by a black and yellow chequered metal flag, at each of the other corners.

Unused spoil grounds lie on the south-western and north-eastern sides of Uran light-beacon as indicated on the chart.

Charts 655, 2621.

Submarine cables.—A submarine cable is laid from the vicinity of Colāba point in a north-easterly direction to Oyster rock and thence to Middle Ground islet.

A submarine cable is laid from the northern end of Butcher island (*Lat. 18° 58′ N., Long. 72° 54′ E.*) in a westerly direction to the coast, and another from the eastern extremity of Butcher island in an easterly direction to Elephanta island.

See page 26.

Chart 655.

Prohibited anchorages.—Anchorage is prohibited in an area on the eastern side of Middle Ground islet as indicated on the chart.

Chart 2621.

Anchorage is prohibited within the area indicated on the chart between Butcher Rock light-beacon and Trombay island.

Chart 655.

Anchorages.—Buoys.—The area indicated on the chart between Sunk rock, Middle Ground islet and the Indian Naval dockyard is reserved for Naval vessels. There are two mooring buoys in this area about 3 and 5 cables, respectively, south-westward of Middle Ground islet.

The usual anchorage for merchant vessels is on the western side of the harbour, abreast the town of Bombay, in depths of from 22 to 37 feet (6^{m}7 to 11^{m}3), but good anchorage may be obtained in other parts of the harbour.

Vessels with a draught of less than 18 feet (5^{m}5) carrying coal are moored between Middle Ground islet and Cross island to discharge their cargo, but generally ships are anchored farther out.

All vessels should be moored, as a general rule, in a south-south-westerly and north-north-easterly direction between 1st October and 31st May with 45 fathoms (82^{m}3) of cable each way, and between 1st June and 30th September with 60 fathoms (109^{m}7) of cable on the southern anchor, and 45 fathoms (82^{m}3) on the northern anchor; a vessel moored in the eddies off Middle Ground islet should have 75 fathoms (137^{m}2) on the southern anchor.

An anchorage for yachts lies off the Naval dockyard and one for dhows is charted north-eastward of Malet shelf. Only yachts and small passenger boats are permitted to pass through the yacht anchorage.

Quarantine anchorage.—The quarantine anchorage is situated in the channel south-eastward of Tucker light-beacon (*Lat. 18° 56′ N., Long. 72° 52′ E.*) as indicated on the chart; it has depths of from 34 to 36 feet (10^{m}4 to 11^{m}0). Vessels subject to quarantine may however be instructed to anchor in a position convenient for the Port Health Officer to board.

Chart 2621.

Explosives anchorages.—Vessels arriving with or embarking explosives, or arriving with petroleum or other dangerous cargoes, will be anchored in the explosives anchorages in the channel to Thāna

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Chart 2621.

creek between Uran light-beacon and Pir Pau deep as indicated on the chart. There are four such anchorages numbered from 1 to 4 from south-west to north-east.

Chart 655.

Signal stations.—Storm signals.—The port signal station is situated in a tower on the southern end of Ballard pier, the dock signal station on Bull's nose at the entrance to Alexandra dock and the naval signal station in the naval barracks about 3 cables westward of the port signal station.

The dock signal station only deals with signals referring to the docking of vessels.

Communication is by means of the International Code of Signals or semaphore by day and by Morse code at night.

Storm signals are displayed from the port signal station and from a flagstaff at Victoria and Prince's docks; the general system is used. Storm warnings are received at Mora/Uran on Karanja island but no signals are hoisted. *See* pages 20 and 23.

Copies of all weather telegrams are displayed at the Deputy Conservator's office and the Dockmaster's office.

Docks.—Lights.—Alexandra dock has a depth of 39 feet (11^{m}9) and a length of quayage of 10,000 feet (3,048^{m}0). The entrance lock is 745 feet (227^{m}1) long and 100 feet (30^{m}5) wide, and has a depth of 27 feet (8^{m}2) on the outer sill and 23 feet (7^{m}0) on the inner sill at low water. In 1958, there were 22 berths in the dock for vessels of from 17 to 29 feet (5^{m}2 to 8^{m}8) draught.

This dock is equipped with all modern appliances for working cargo; it is connected to the railway system, and water is laid on. Hughes dry dock (for details *see* Appendix I on page 343) is entered from the southern end of Alexandra dock (*Lat. 18° 56′ N., Long. 72° 51′ E.*).

Vessels are handled at night in Alexandra dock, except under exceptional circumstances, to be decided by the Deputy Conservator. When a vessel is entering or leaving the dock by day, a blue flag is hoisted at the dock flagstaff on Bull's nose.

Depths of from 25 to 26 feet (7^{m}6 to 7^{m}9) are charted alongside the southern end of the outside wall of Alexandra dock. Masters of deep-draught vessels should however confirm these depths with the Deputy Conservator before proceeding alongside as silting is constantly taking place and these depths may not exist.

The eastern wall of the entrance lock is known as Bull's nose; the dock signal station and flagstaff stand on the southern end of Bull's nose.

The western side of the entrance lock is continued south-south-eastward for about 1,700 feet (518^{m}2) to form Ballard pier; this pier, which is about 400 feet (121^{m}9) wide at its southern end, has a dredged depth of 32 feet (9^{m}8) alongside but, owing to silting, this is likely to vary. The port signal station and flagstaff are situated near the south-eastern extremity of the pier. Ballard pier is the main terminal for large passenger vessels and is connected with the general railway system.

The approach channel to the entrance lock to Alexandra dock and Ballard pier is dredged to a depth of 25 feet (7^{m}6) but, in 1958, there was a depth of only 23 feet (7^{m}0) and it is liable to vary.

Charts 737, 2736, 826, 748b.

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Chart 655.

Leading lights are exhibited from the centre of Ballard pier; the front light, at an elevation of 25 feet (7m6), from a framework structure with two discs, and the rear light, at an elevation of 41 feet (12m5), from a mast with two discs. These lights, in line bearing 305°, lead through the centre of the approach to the pier.

Victoria dock (*Lat. 18° 57′ N., Long. 72° 51′ E.*), situated northward of Alexandra dock, is 1,270 feet (387m1) in length, 1,000 feet (304m8) in breadth, with a depth of 33¼ feet (10m1). The width of the entrance is 80 feet (24m4), and the depth on the sill 16 feet (4m9); the limiting draft for vessels entering this dock is 22 feet (6m7).

The dock is equipped with all modern appliances for working cargo, and it is connected with the railway system.

A channel, which, in 1957, had depths of from 7 to 13 feet (2m1 to 4m0), leads to the entrance to Victoria dock; the channel is liable to change. When eastward of North Channel light-beacon the leading marks are a disc on a small flagstaff on the northern side of the northern entrance to Prince's dock in line with a double disc in the background, bearing 280°. After passing northward of North Channel light-beacon the leading marks are the framework signal staff on the northern side of the dock entrance in line with the southern leading mark in the background, bearing about 250°.

At night a light is exhibited from the signal staff when the dock gates are open.

Prince's dock, northward of Victoria dock, is 1,460 feet (445m0) long, 1,000 feet (304m8) wide, with a depth of 31½ feet (9m5). The width of the entrance is 66 feet (20m1) and the depth on the sill is 14 feet (4m3); the width of the passage into Victoria dock is 64 feet (19m4) and the depth on the sill between the two docks is 16 feet (4m9); Prince's dock has a limiting draft of 19 feet (5m8).

The channel leading to Victoria dock, described above, also leads to Prince's dock; the leading marks for the centre of the channel are those described for a vessel when eastward of North Channel light-beacon. The northern limit of the channel is defined by leading marks, each consisting of a cone on a pole; the southern limit is similarly defined by marks, each consisting of a drum on a pole.

When the dock gates are open lights are exhibited from the leading marks defining the centre and northern limit of the channel.

A vessel can only be taken into Prince's dock from about 2½ hours before the time of high water to half an hour after the time of high water. She cannot be taken out after the time of high water, even though it is customary for a tug to be in attendance at the dock gates. This is due to the out-going stream commencing in that vicinity about 1½ hours before the time of high water, and setting directly down on to the reef northward of Cross island about the time of high water.

The Naval dockyard is approached between the southern end of Ballard pier and the north-eastern end of Breakwater pier (*Lat. 18° 56′ N., Long. 72° 50′ E.*), about 2½ cables south-westward.

A light is exhibited, at an elevation of 27 feet (8m3), from a steel column, 16 feet (4m9) in height, situated on the head of Breakwater pier.

Leading lights are occasionally exhibited, the front at an elevation of 46 feet (14m0) and the rear at an elevation of 75 feet (22m9), from two steel framework beacons, each surmounted by a white triangle

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Chart 655.

with a red vertical stripe, situated about 2½ cables westward of the head of Breakwater pier; in line, bearing 266°, they lead close northward of the head of Breakwater pier to the dockyard. In 1960, there were depths of 8 feet (2m4) on the leading line but the depths in the approach to the dockyard are liable to constant change.

Vessels are taken into the dockyard basin from 1½ hours before the time of high water until high water, and into dry dock from one hour before to one hour after the time of high water. *See* caution on page 247.

Chart 2621.

Oil wharves.—Lights.—A concrete jetty, about 1,700 feet (518m2) long, with three pier heads with dolphins at either end, extends from the eastern side of Butcher island (page 239); the jetty carries a roadway and pipeline and has berths for three tankers of up to 800 feet (243m8) in length and 34½ feet (10m5) draught. In 1960, construction was still in progress in the area of the jetty.

Pir Pau wharf for vessels discharging petroleum in bulk lies off the southern side of Trombay island (page 242), to which it is connected by a pile pier, which carries the pipeline. The wharf is 570 feet (173m7) long and has a dredged depth of 29 feet (8m8) alongside.

A light is occasionally exhibited, at an elevation of 15 feet (4m6), from each end of the wharf, and six lights are shown along the length of the wharf.

When tankers are discharging at the wharf, a light is exhibited, at an elevation of 38 feet (11m6), from a mast situated on the centre of the wharf.

Charts 655, 2621.

Tidal streams (continued from pages 235-236).—On the eastern shore of the bay the flood stream sets in a north-easterly direction along the west coast of Karanja island (*Lat. 18° 52′ N., Long. 72° 56′ E.*), setting in a more easterly direction after passing North Karanja light-buoy. It sets north by east between Butcher and Elephanta islands, and then in a north-easterly direction towards Trombay island. Midway between Butcher island and Pir Pau wharf the two streams meet, setting between north and east-north-east.

On the western shore, from Sunk rock to Cross island, the flood stream sets between north by east and north-north-east; northward of Tucker light-beacon, where the streams separate, it sets more northward, and from Cross island to abreast Mazagon pier, situated about one mile northward, between north and north by east; thence, to where the streams meet between Butcher island and Pir Pau wharf, it sets between north-east and east-north-east.

The ebb stream sets a little west of south-west from southward of the channel between Butcher and Elephanta islands along the west coast of Karanja island as far southward as South Karanja buoy, from where it sets in a south-westerly direction until abreast Dharamtar creek where it changes to a west-south-westerly direction.

On the western shore from Trombay island to abreast Mazagon pier the ebb stream sets between south-west and west to south-south-west, and thence, eastward of Cross island, in a south by west direction. From Cross island to inside Middle Ground islet it sets in a south-south-westerly direction and from there to Sunk rock in a south by west direction. From Cross island to eastward of Middle Ground islet, in mid-channel, the ebb stream sets between south by west and south-

Charts 737, 2736, 826, 748b.

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Charts 655, 2621.

south-west, and thence to Sunk rock it sets in a south by west direction, but at the first of the ebb the set is here more westerly.

Chart 655.

At springs the flood stream southward of Dolphin rock has a rate of 2 knots and the ebb 1½ knots. In other parts of the harbour, the rate is from half to 1½ knots.

The ebb stream on the western shore of Bombay harbour makes down during ordinary tides from 30 to 35 minutes earlier than on the eastern shore, and during strong spring tides from 40 minutes to one hour sooner.

Inshore and near Alexandra dock wall, during the south-west monsoon, the ebb stream makes about three-quarters of an hour before the time of high water. This is important to a vessel docking.

Chart 2621.

Directions.—Large vessels can enter Bombay harbour either by day or at night.

Vessels should make Bombay Floating light and then steer for the pilot vessel's cruising ground with Karanja hill in line with the mosque on the coast, about 9 cables westward, bearing about 083°; this will lead about 1¾ miles southward of Prongs reef and between the light-buoys marking the northern and southern sides of the fairway.

If awaiting a pilot, vessels should anchor, draught permitting, south-eastward of Sunk Rock light-structure.

Vessels approaching from southward should pass westward of the black conical buoy marking Thāl shoal.

All vessels making the port during daylight must hoist their national ensign, and make their name by the International Code of Signals to Prongs Reef lighthouse.

During the south-west monsoon, when the weather may be such as to make it difficult to identify the marks, or during the cold weather when a great smoke-haze often obscures the view, the best time to make the port is about one hour before sunrise, as the lights being then visible, will enable the mariner to obtain an accurate position.

See caution on page 232 regarding fishing stakes; they may also be encountered within the harbour.

Fishing lines, marked by black buoys, will often be found southward of Sunk rock.

Chart 655.

Caution.—It has been observed that the flood tidal stream divides in the vicinity of Ballard pier (*Lat. 18° 56′ N., Long. 72° 50′ E.*), on the northern side of the entrance to the dockyard basin, causing an anti-clockwise movement off the Naval dockyard, the stream taking a southerly direction near Breakwater pier. Caution should be exercised when entering or leaving the dockyard if there is any appreciable tidal stream in Bombay harbour. Vessels necessarily approach at slow speed with little steerage way, and if entering with a flood tidal stream are recommended to keep the rear leading beacon slightly open northward of the front beacon, to avoid being set on to Breakwater pier.

Bombay.—Bombay is the principal seaport on the west coast of India. The city, which is the capital of Maharashtra state, is connected by railway embankments with the larger island of Salsette, northward, and so continuously with the mainland.

The city of Bombay consists generally of well-built houses and broad

Charts 737, 2736, 826, 748b.

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Chart 655.

streets; the most conspicuous public building is the Taj Mahal hotel, which is surmounted by a dome 229 feet (69m8) high, and is situated about 2 miles north-eastward of Colāba point; amongst those in the densely-built tract known as Fort, the central part of the city, are the cathedral and the municipal buildings, the tower of which is 233 feet (71m0) high. A tower with a white dome, 174 feet (53m0) high, lies about 9½ cables northward of the municipal buildings.

Amongst the prominent buildings, standing on the esplanade on the eastern shore of Back bay, is the conspicuous clock tower of Rajabaee, 280 feet (85m3) high, which stands about 5¼ cables north-north-westward of Taj Mahal hotel (*Lat. 18° 55′ N., Long. 72° 50′ E.*).

A conspicuous chimney, 180 feet (54m9) high, and the prominent spire of St. John's Church, 181 feet (55m2) high, stand on Colāba peninsula about 6½ cables south-south-westward and 1¼ miles south-westward, respectively, of Taj Mahal hotel.

In 1951, the population of the city of Bombay was 2,839,270.

Port facilities.—Large quantities of fuel oil and diesel oil can be obtained at special berths. Vessels can be supplied at a rate of 30 to 40 tons per hour by gravity, and 135 to 170 tons per hour can be pumped on board.

Coal can be obtained.

Fresh meat and bread are plentiful; vegetables are plentiful from November to April, but scarce at other times.

Water is laid on to the quays, the hydrants supplying from 3,000 to 5,000 gallons per hour. The port department water-boats each have a capacity of 270 tons; there are two water-boats, for which application should be made to the Deputy Conservator's office.

There are ample tugs.

Large repairs can be executed.

There are ten dry docks and two patent slips at Bombay; for details of Hughes dock, the largest dry dock, *see* Appendix I.

There is a Sailors' Home close to Ballard pier, and another close to Victoria and Prince's docks.

Deratisation.—*See* page 29.

Communications.—There is regular communication by sea with all the principal ports of India, and with Europe, Australia, the Far East, East Africa, the Persian gulf and the islands in the South Indian ocean.

There are air services with Europe, Africa and the Far East and also with other cities and towns in India.

Trade.—The chief imports are coal, iron and steel, motor vehicles, kerosene, petrol, fuel oil, cotton, glassware, oilmanstone, grain, timber mill machinery and stores, generators and electrical equipment, mutton tallow, dyes and chemicals. The main exports are seeds, cotton (raw and manufactured), kerosene, fuel oil, oil cakes, spices, sugar, manganese and iron ore, husks, skins, bristles, brass artware, yarn and wool.

Life-saving.—One power life-boat is maintained.

Radio station.—There is a radio station at Bombay (*Lat. 18° 56′ N., Long. 72° 50′ E.*). *See* page 24.

Climatic table.—*See* page 52.

Charts 2621, 737.

Dharamtar creek.—Light.—Anchorage.—Dharamtar creek, into

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Charts 2621, 737.

the head of which flows Pen (Ambā) river, is entered north-eastward of Kansa islet. There is a least depth of about 14 feet (4^m3) for about 3 miles eastward of Kansa islet (page 231), but from thence the depths decrease gradually to the mud banks which fringe the coast on either hand. Fishing stakes will be encountered in the creek.

A light is exhibited, at an elevation of 18 feet (5^m5), from a black wooden post, 10 feet (3^m0) in height, situated about 8 cables south-eastward of Naukhari point, the southern entrance point of Dharamtar creek.

Good anchorage for small vessels can be obtained about $6\frac{1}{4}$ cables southward of the white boundary pillar at the southern end of Karanja island in charted depths of from 14 to 17 feet (4^m3 to 5^m2).

Chart 737.

Pen river.—Pen (Ambā) river is about 2 miles wide at its entrance, with a depth of about 6 feet (1^m8); it has a general south-south-easterly direction, and narrows to half a mile between the mangroves which fringe its banks. The least depth as far as Dharamtar, about 7 miles up the river, is 5 feet (1^m5); through this portion a mid-channel course should be steered.

At Dharamtar there are a large wooden pier, two stone causeways and a rest-house. There is a regular ferry service to Bombay.

Panvel river.—Dangers.—Buoy.—Beacon.—Storm warnings.—Panvel river is navigable by small vessels with local knowledge as far as Ulvā bandar, on the southern side of the river, about 5 miles within the entrance, the least depth being 6 feet (1^m8).

A sand and mud bank, which dries, extends about 3 miles south-westward from the northern entrance point of the river; near the south-western end of this bank are numerous rocky shoals, with depths of less than 6 feet (1^m8) over them, and which are marked on their southern side by a buoy, painted black and white.

The channel to Ulvā bandar is marked by one beacon and several buoys; in 1956, the beacon had collapsed. There is a small pier at Ulvā bandar.

Storm warnings are received at Panvel, about 4 miles eastward of Ulvā bandar, but no signals are hoisted. *See* page 23.

Thāna creek.—Dangers.—Tidal streams.—Storm warnings.—The depths in Thāna creek decrease gradually from about 3 fathoms (5^m5) off the entrance to Pir Pau deep (page 242) to from 2 to 4 feet (0^m6 to 1^m2) off the town of Thāna, about 14 miles northward of Elephanta island.

At low water the creek is lined by mud banks except on the eastern side, between 2 and $4\frac{1}{2}$ miles above Trombay village, where there are rocky ledges and mud banks. The shores are fringed with mangroves, inside of which the land is cultivated.

From the custom house, half a mile below the town of Thāna (*Lat. 19° 11′ N., Long. 72° 59′ E.*), to the junction of Thāna and Bassein (page 253) creeks, about 2 miles above the town, the channel is rocky and dries in places.

The strength of the tidal streams in the middle of Thāna creek is about one knot at springs.

Storm warnings are received at Thāna but no signals are hoisted. *See* page 23.

Charts 2736, 826, 748b.

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CHAPTER VII

BOMBAY HARBOUR TO VOMANI POINT INCLUDING THE GULF OF CAMBAY

Chart 2736.

Coast.—General remarks.—From Worli (Warli) point (*Lat. 19° 01′ N., Long. 72° 49′ E.*), the north-western extremity of Bombay island, the coast trends in a general direction northward for about 125 miles to Suváli point, and is generally low; from Arnāla island, about 26 miles northward of Worli point, the coast is so low that much of it is submerged at high-water spring tides; this latter part of the coast is thickly wooded. The coast is fronted by reefs or by shoal water, which extend some distance offshore.

Chart 736.

Between Māhīm, about 10 miles northward of Arnāla island, and Umbargaon, about 34 miles further northward, a partially wooded range, the summits of which are prominent from seaward, lies from about 7 to 12 miles inland; Kāldurg peak, about 6 miles north-eastward of Māhīm, is 1,528 feet (465^{m}7) high, and resembles a castle when seen from the north-westward; Muslia (Maha Luxmi or Valentines) peak, about 15¾ miles north-north-eastward of Kāldurg peak, has a pointed summit about 1,500 feet (457^{m}2) high; a range, about 9½ miles north-north-westward of Muslia peak, slopes gradually in a northerly and southerly direction from its centre, High Land of St. John, which is a rounded mountain, about 1,770 feet (539^{m}5) high.

Charts 735, 736, 2736.

Between Worli point and Tārāpur point, about 49 miles northward, a vessel can approach the coast in fine weather, proceeding into depths of from about 6 to 8 fathoms (11^{m}0 to 14^{m}6), but northward of the latter point, as far as Damān, about 36 miles north-north-eastward, a vessel should not proceed into depths of less than 10 fathoms (18^{m}3). Between Damān and Suváli point there is a very shallow bight, and in this neighbourhood the coast may be approached to a depth of 10 fathoms (18^{m}3); care must however be taken to avoid Malacca banks, which lie to the westward in this vicinity, and a shoal bank, with a least depth of 7 fathoms (12^{m}8), lying between Malacca banks and the coast, about 15 miles north-westward of Damān.

Chart 737.

Coast.—Dangers.—Lights.—Beacons.—Buoyage.—From Worli point the coast trends northward for about 17 miles to Dongri point.

Worli point and the shoals off it are described on page 235.

Between Worli point and Bāndra point, the southern extremity of Salsette island, about one mile north-north-eastward, is Māhīm bay, which is the shallow and rocky entrance to Māhīm river.

Charts 826, 1012, 748b.

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Chart 737.

Jamsetji causeway extends across the mouth of Māhīm river in the north-eastern corner of Māhīm bay, and connects the northern end of Bombay island to the southern end of Salsette island.

Shoals, with a least depth of 2¼ and 2½ fathoms (4m1 and 4m6), lie about 1½ miles west-north-westward and westward of Bāndra point.

A small vessel, with local knowledge, can obtain some shelter under Bāndra point from north-westerly winds.

The town of Bāndra, situated on Bāndra point, is connected with the general railway system.

The western side of Salsette island is fronted by islands and islets, which are divided from it by creeks and drying reefs, and from which foul ground extends about 1½ miles westward.

Fishing stakes extend about 10 miles offshore; vessels, other than coasting craft, should give them a wide berth by keeping in a depth of not less than 12 fathoms (21m9).

The mountain range on Salsette island is described on page 230.

Uarashi is a reef, the southern end of which is situated about 2 miles northward of Bāndra point (*Lat. 19° 02′ N., Long. 72° 49′ E.*) and about 6 cables offshore; some rocks, one of which is awash, lie about three-quarters of a mile north-westward of the light-beacon situated on the southern end of the reef.

A light is periodically exhibited at an elevation of 33 feet (10m1) from a beacon, 34 feet (10m4) in height, situated at the southern end of Uarashi.

A light for the use of aircraft is exhibited from a position about 3 miles east-north-eastward of Uarashi light-beacon.

Juhu island, the southern end of which is situated about one mile east-north-eastward of Uarashi light-beacon, has a sandy coast; it is covered with coconut and date palms, and is connected with Salsette island eastward by a drying reef.

Andheri hill, 200 feet (61m0) high, about one mile eastward of the north-eastern point of Juhu island, is isolated and almost bare.

A small reef which dries, a rock with a depth of less than 6 feet (1m8) over it and a 6-foot (1m8) patch lie about 6 and 8 cables westward and 8 cables west-north-westward, respectively, of the northern extremity of Juhu island.

Hervey patches, marked by a red conical buoy, and situated about 2 miles westward of the northern end of Juhu island, have depths of from 6 to 9 feet (1m8 to 2m7); the sea always breaks over these shoals.

Vesāva island, the southern end of which is situated about 3½ cables northward of Juhu island, is covered with palms; there are several houses at the southern end, and the fishing village of Vesāva occupies the northern end of the island. Vesāva island is connected to Salsette island by a causeway.

Madh island, close north-westward of Vesāva island, is about 120 feet (36m6) high and well cultivated with coconut and fruit trees; there is a fort, in ruins, on its south-eastern point, and there are some ruins on its summit. Madh village is situated on the western side of the island, about 6 cables from its southern end, and Erangal village, near the northern end. There is a ferry between Madh and Vesāva islands.

A light is exhibited, at an elevation of 45 feet (14m0), from a white

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Chart 737.

mast, 50 feet (15m2) in height, situated on the eastern extremity of Madh island.

Mālād creek, the entrance to which lies between the south-eastern extremity of Madh island and the shoal ground extending south-westward from Vesāva island, dries except for a narrow channel which extends about 2¾ miles from the entrance; the channel is marked by a buoy as indicated on the chart.

The tidal streams set strongly through Mālād creek, often attaining a rate of 5 knots.

Reefs extend about 6 cables westward from Madh island; Ambu islet, at the south-western edge of these reefs, is low, covered with palms and has on it an old watch-tower; Mehti Khada, a rock 14 feet (4m3) high, situated half a mile westward of Ambu islet and composed of basalt, is very small and steep-to on its western side.

Marva island, low and covered with palms, lies close northward of Madh island; a beacon stands on the western side of Marva about 6 cables southward of the northern extremity, where there is a customs house.

Manori creek, the entrance to which lies between the western side of Marva island and the southern end of Dharavi island, about 3 cables north-westward, is a shallow creek available only for a small vessel with local knowledge.

Dharavi island is the northernmost of the islands facing Salsette island; at its northern end is Bassein creek. Reefs and foul ground extend 1½ miles westward from the island.

Manori point, the southern end of Dharavi island, is a bluff of dark bare rock, 99 feet (30m2) high; the village of Manori stands about three-quarters of a mile northward of the point; the village has a church at its southern end.

Gorai rock, a conspicuous sharp pinnacle of black rock, 99 feet (30m2) high, about 3¼ miles north-north-eastward of Manori point (*Lat. 19° 12′ N., Long. 72° 47′ E.*) and about 1½ miles inland, is a good landmark.

Eksar temple, with a white dome, is situated on the northern summit of a round hill, 117 feet (35m7) high, about 2¾ miles eastward of Gorai rock; the dome is conspicuous from seaward.

Green islet, situated about 2¾ miles north-north-westward of Manori point and about three-quarters of a mile from the western side of Dharavi island, is from 3 to 4 feet (0m9 to 1m2) high, covered with short green scrub and surrounded by a ledge of rocks.

Outer islet, about 1½ miles north-north-westward of Green islet and about 1¼ miles from the western side of Dharavi island, is about 7 feet (2m1) high, composed of sand and is situated at the southern end of a drying reef; on this drying reef, about one mile northward of Outer islet, is High rock, a sharp pinnacle, 23 feet (7m0) high.

The passage eastward of Green islet, Outer islet and High rock is foul, and cannot be navigated.

A salient point, 125 feet (38m1) high, is situated about 5 miles northward of Manori point; the fishing village of Utan stands on the shore of the bight close northward of this point.

A light is exhibited, at an elevation of 175 feet (53m3), from a square black and white masonry tower, 40 feet (12m2) in height, at Utan.

Dongri point, on the southern side of the entrance to Bassein creek,

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Chart 737.

is a bluff point as seen from seaward. It rises to an elevation of over 300 feet (91m4) about half a mile southward, sloping gradually to level country about 2 miles farther southward.

A light is periodically exhibited, at an elevation of 46 feet (14m0), from an iron column 7 feet (2m1) in height, situated on Dongri point.

Storm signals.—Storm signals are displayed from a position near the north-western extremity of Vesāva island; the brief system is used. Storm warnings are received at Bāndra and Manori but no signals are hoisted. *See* pages 20 and 23.

Anchorages.—A small vessl can obtain anchorage close southward of Madh island, with shelter from northerly winds, in depths of 2½ fathoms (4m6), soft mud.

A small vessel with local knowledge can obtain sheltered anchorage in Manori creek, with Manori church bearing 270°, in a depth of 15 feet (4m6), sand.

Bassein creek.—Bassein creek, the entrance to which lies between Dongri point and a point about 6 cables north-eastward, is a tortuous creek, with shoal water extending across its entrance; it can only be navigated by small vessels with local knowledge and of a draught not exceeding 12 feet (3m7). In the south-west monsoon the sea breaks heavily across the entrance.

Dongri village lies on the southern side of the creek, about one mile south-south-eastward of Dongri point (*Lat. 19° 18′ N., Long. 72° 47′ E.*).

Bhayandar village, about 2½ miles eastward of Dongri, is connected with the railway system; there is a stone wharf with a railway siding close to it.

Ghod Bhandar, a village about 2¼ miles eastward of Bhayandar, has a small stone pier. Ghod Bhandar temple is a large building, with a white dome, on the summit of a hill, 113 feet (34m4) high, at the north-western end of the village; there are several ruined buildings near this temple.

Dangers.—Light.—Island.—Poshpir, a rocky islet 36 feet (11m0) high, lies about 2¼ miles north-westward of Dongri point; a reef extends about three-quarters of a mile north-westward from the islet.

Rocks, which dry, extend about 1½ miles west-north-westward from Dongri point, and sandbanks, which also dry, extend about three-quarters of a mile south-westward from the northern entrance point of the creek. When there is no wind the sea does not break on them, and there are no indications of their existence. These sandbanks probably shift their positions every year during the south-west monsoon.

There are depths of less than 3 fathoms (5m5) for a distance of about 3 miles westward of the entrance to Bassein creek, and a detached 3-fathom (5m5) shoal is situated about 3½ miles west-north-westward of Dongri Point lighthouse and about 3 miles offshore.

Close eastward of Dongri point the deepest water will be found near the north-western shore of the creek; on its southern side, as far eastward as Panju island, the creek is encumbered with sandbanks.

A light is exhibited, at an elevation of 16 feet (4m9), from an iron post on a masonry base, situated on a reef, on the north-western side of Bassein creek, about 1¾ miles north-eastward of Dongri point.

Panju island, the western extremity of which is situated about 2¾ miles north-eastward of Dongri point, is low and swampy. The railway crosses the island on an embankment, which is connected with the

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Chart 737.

mainland on both sides by iron bridges; on the island, on the western side of the railway, is a small native village with a large stone house, and on the eastern side are workshops and houses. The remainder of Panju island is covered with salt pans, and its coasts are fringed with mangroves.

The channel southward of Panju island is encumbered with sandbanks and shoals.

Eastward of Ghod Bhandar village, a large shoal, with depths of from one to 3 feet (0m3 to 0m9), gravel and small stones, lies in the fairway.

From about one mile above Ghod Bhandar (*Lat. 19° 18′ N., Long. 72° 53′ E.*) the creek narrows to less than 2 cables, and trends for about two miles between steep-sided hills covered with jungle; this part of the creek is comparatively deep, and, with the exception of some rocks and sandbanks, which dry and adjoin the shores, is free from dangers.

Close offshore, on the southern side of the narrows, about 2¾ miles above Ghod Bhandar, is a detached rock, which dries; this rock is close to a small point.

Tidal streams.—The tidal streams in Bassein creek attain a rate of 3 knots at springs, but about 5 miles within the entrance the rate decreases to from 1½ to 2 knots. In the creek the tidal streams continue to set for about one hour after the times of high and low water, respectively; there is slack water for about 15 to 25 minutes.

Anchorage.—Directions.—It is reported that there is a depth of about 3 feet (0m9) at low water, and of about 14 feet (4m3) at high-water springs in the fairway, but these depths cannot be relied on. The entrance to the creek is always difficult except at slack water, as both flood and ebb tidal streams set across the channel.

The navigation of Bassein creek should not normally be attempted without local knowledge, but the following remarks may be useful in an emergency:—A vessel should keep in depths exceeding 3 fathoms (5m5) until Poshpir bears 090°, and then alter course to 096°, passing 1½ cables southward of Poshpir. When High rock is in line with Outer islet, bearing about 198°, course should be altered southward so as to steer for the sandy beach westward of Dongri point, bearing about 160°. A soon as the depths increase, course can be altered eastward into the creek, keeping close to the southern shore.

From abreast Dongri point (*Lat. 19° 18′ N., Long. 72° 47′ E.*) a north-easterly course should be steered towards the north-western side of the creek, keeping in depths of from 2 to 4 fathoms (3m7 to 7m3) till close to the northern shore; a vessel should then alter course east-north-eastward, keeping about one cable offshore until abreast Bassein fort, which is situated on the north-western side of the creek, about one mile within the entrance; good anchorage can be obtained here in depths of from 5 to 6 fathoms (9m1 to 11m0), mud. Vessels should moor head and stern.

A vessel proceeding farther up the creek will obtain the greatest depths by keeping close to the north-western side of the creek until abreast the western extremity of Panju island, when a mid-channel course should be steered between the mainland and the northern side of Panju island until Ghod Bhandar temple bears 180°; a vessel should then steer towards the southern side of the creek, which can be followed at a distance of from half a cable to one cable as far as the

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Chart 737.

creek has been sounded. The bends should be followed and the points avoided as in most river navigation. There is a boat passage to Thāna (page 249), and from thence into Bombay harbour.

Bassein.—Bassein, a town about half a mile inland and northward of Bassein fort, has a good landing place, a stone pier and a custom house. The fort, with the ruins of the citadel in the middle, stands close to the landing place.

Bassein is about 4½ miles from the railway station.

The vessels belonging to the port are fishing and small trading craft, of from 50 to 70 tons. Local vessels of the same size visit the port.

Provisions may be obtained in moderate quantities, and bread at a day's notice.

Storm warnings.—Storm warnings are received at Bhayandar and Bassein but no signals are hoisted. *See* page 23.

Charts 736, 737.

Coast.—Dangers.—Lights.—From the entrance to Bassein creek the coast has a general north-north-westerly direction for about 8 miles to a low point, within 2 miles eastward of which are several villages and the town of Agāshi; this part of the coast is very low. Shoal water, with depths of less than 3 fathoms (5^{m}5), extends about 2 miles offshore, and part of this area has not been examined.

Chart 737.

Girij hill, 168 feet (51^{m}2) high, about 3½ miles northward of the northern entrance point of Bassein creek and about 1¾ miles inland, is a small round hill.

Kamandurg, about 9½ miles eastward of Girij hill, and the plateau of Tungar, about 4½ miles north-north-eastward of Kamandurg, are described on page 230.

Charts 736, 737.

Arnāla island (*Lat. 19° 27′ N., Long. 72° 44′ E.*) is 7 feet (2^{m}1) high, and has on it a small fort; the island is fringed by rocks on all sides, which extend about half a mile from it; shoal water, with depths of less than 3 fathoms (5^{m}5), extends about 1¼ miles westward from the island. For radar range *see* Appendix III on page 346.

A light, called Arnāla light, is exhibited, at an elevation of 30 feet (9^{m}1), from an iron structure, 32 feet (9^{m}8) in height, situated on the coast, abreast the southern end of Arnāla island.

Chart 736.

Between the northern end of Arnāla island and the mainland, about 3 miles north-north-eastward, lies Agāshi bay, which is the entrance to Vaitarna (Waitarna) river. The bay is very shallow, is encumbered with shoals and can only be navigated by a small vessel at about the time of high water.

From the northern entrance point of Agāshi bay the coast trends north-north-westward for about 5 miles to the entrance to Dānda creek; there are two or three villages on this part of the coast.

Ussapur rock, situated on the coastal reef, about 4½ miles northward of Arnāla island and about a quarter of a mile offshore, is high and connected to the mainland eastward by a drying reef; rocks, which dry, extend about three-quarters of a mile westward from this rock.

Charts 2736, 826, 1012, 748b.

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Chart 736.

Dānda creek is the entrance to Mur river; there is a small detached rock, with a fort on it, just westward of the entrance to the river. The villages of Dāndepāda and Kelve stand on the southern and northern sides, respectively, of the entrance to the river.

A light is exhibited, at an elevation of 45 feet (13m7), from a white mast, 45 feet (13m7) in height, near the customs house at Kelve.

A detached one-fathom (1m8) shoal lies about 1¾ miles westward of Kelve.

Māhīm is a town on the coast, on the northern side of the entrance to Māhīm creek, about 2 miles northward of Kelve.

A detached 3-fathom (5m5) shoal is situated about 3¾ miles westward of Māhīm and about 3¼ miles offshore.

On the coast, about 3½ miles northward of Māhīm, is a village called Shirgaon.

Satpati village, about 1¾ miles northward of Shirgaon (*Lat. 19° 41′ N., Long. 72° 43′ E.*), lies on the southern side of the entrance to Dudh river; this river, which is about half a mile wide at its entrance, is encumbered with rocks and very shallow.

A light, known as Satpati light, is exhibited, at an elevation of 54 feet (16m5), from a white masonry pillar with black bands, situated on the coast about half a mile southward of Satpati village.

This part of the coast is very foul, reefs that partly dry extending about 2 miles offshore.

Kāldurg peak (page 250) is situated about 6 miles north-eastward of Māhīm.

Between the northern entrance point of Dudh river and Tārāpur point, about 6 miles northward, the coast is low, rocky and densely wooded; a vessel should not proceed into depths of less than 8 fathoms (14m6) off this part of the coast.

Foul ground extends about three-quarters of a mile westward from Tārāpur point, and a narrow reef extends about 2¾ miles north-north-westward from its northern extremity.

Chinchani-Tārāpur creek lies about 1½ miles north-eastward of the northern extremity of Tārāpur point; the towns of Tārāpur and Chinchani stand on the southern and northern sides, respectively, of the entrance.

Vādhavan point, a low point with mangrove bushes about 5½ miles northward of Tārāpur point, has foul ground extending about 2¾ miles south-south-westward, and about 1¾ miles westward and north-westward from it; a reef, which almost dries, extends about 2¼ miles northward from the north-western edge of the foul ground north-westward of Vādhavan point.

Tārāpur harbour is formed by the barrier reefs extending north-north-westward from Tārāpur point and south-south-westward from Vādhavan point.

Muslia (Maha Luxmi or Valentines) peak (page 250) is situated about 15 miles eastward of Vādhavan point.

Charts 736, 735.

Extensive reefs and foul ground extend up to 4 miles offshore, northward of Vādhavan point, nearly to Damān, a distance of about 30 miles.

A vessel should not approach the coast in depths of less than 10 fathoms (18m3) when navigating in this vicinity.

Charts 2736, 826, 1012, 748b.

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Chart 736.

Dāhānu village lies on the northern side of the entrance to Khondha creek, about 4¼ miles north-eastward of Vādhavan point.

Northward of Dāhānu the hills commence about 4 miles inland, whence they gradually increase in size and become, at the distance of 5 miles, a continuous chain of low hills, some of which are wooded, lying parallel with the coast. High Land of St. John, about 1,770 feet (539^{m}5) high, about 12¼ miles north-eastward of Vādhavan point, is described on page 250.

A light is exhibited, at an elevation of 43 feet (13^{m}1), from a white steel framework tower, 39 feet (11^{m}9) in height, at Dāhānu village.

Gulúr point (*Lat. 20° 04′ N., Long. 72° 43′ E.*), about 6¼ miles northward of the entrance to Khondha creek, is low and covered with coconut trees; foul ground extends about 3¼ miles westward from this point.

Umbargaon, about 8 miles north-north-eastward of Gulúr point, is a small town with a tower, in ruins, on the southern side of the entrance to Varoli river, which is the northern boundary of High Land of St. John.

The coast between Gulúr point and Umbargaon is low and sandy, and foul ground extends about 4 miles offshore.

Charts 735, 736.

The coast between Umbargaon and Damān, about 13 miles north-north-eastward, is low and fringed with bushes. There are several prominent hills on this part of the coast:—Patia hill, about 4 miles north-eastward of the entrance to Varoli river, is 327 feet (99^{m}7) high; Dhodi pahar, about 2¼ miles north-north-eastward of Patia hill, is 484 feet (147^{m}5) high; Jogmari hill (Wooded summit), about 3¼ miles north-eastward of Dhodi pahar, is 759 feet (231^{m}3) high; and Indragad hill, about 2 miles northward of Jogmari hill, is 353 feet (107^{m}6) high and has the ruins of a fort on its summit.

A light is periodically exhibited, at an elevation of 40 feet (12^{m}2), from a white steel framework tower, 35 feet (10^{m}7) in height, at Maroli, about 6 miles northward of the entrance to Varoli river.

Chart 735.

Kālu river, the entrance to which lies about 10¾ miles north-north-eastward of the entrance to Varoli river, forms the southern boundary of the Portuguese possession of Damān for about 2 miles from its mouth.

Rio Dāmānganga (Daman Gunga river) flows into the sea about 2½ miles northward of the mouth of Kalu river.

Chart 736.

Storm signals.—Storm signals are displayed from Arnāla island, the vicinity of the light-structure at Kelve, a flagstaff on the foreshore at Satpati, the fort at Tārāpur and the fort at Dāhānu; the brief system is used at all these places. Storm warnings are received at Umbargaon but no signals are hoisted. *See* pages 20 and 23.

Anchorages.—Tārāpur harbour affords anchorage to small vessels with local knowledge in charted depths of from one to 2½ fathoms (1^{m}8 to 4^{m}6).

A small vessel may obtain anchorage about 4¼ miles westward of Dāhānu in depths of 3 fathoms (5^{m}5). A vessel proceeding to this anchorage should pass close northward of the reef, which almost dries, extending northward from the north-western edge of the foul ground

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Chart 736.

north-westward of Vādhavan point; the least depth in the entrance is 2 fathoms (3m7).

Chart 735.

Damān.—Signal station.—Storm signals.—Damān (*Lat. 20° 24′ N., Long. 72° 49′ E.*), known to the Portuguese as Damão, is the capital of the Portuguese settlement of the same name; it lies on both sides of Rio Damānganga and can be identified by the forts on either sides of the river entrance, and by two square steeples and its white buildings. Other landmarks are Indragad hill (page 257), and a 356-foot (108m5) hill about 4¾ miles north-north-eastward of Indragad; there is an idgah, or Mohammadan place of prayer, on the summit of the 356-foot (108m5) hill.

Damān is connected with the general railway system, and, in 1960, had a population of about 7,000.

Provisions may be obtained at Damān.

There is a signal station at Damān from which storm signals are displayed; the brief system is used. *See* page 20.

Depths.—Lights.—The bar at the mouth of Rio Damānganga is flat, mostly hard sand, except northward of the northern point of the river entrance, where the rocky ground projects some distance offshore; it has a depth of one foot (0m3) or less over it. There are depths of from 18 to 20 feet (5m5 to 6m1) between the forts off the town, where the bottom is soft mud.

A light, known as Damão light, is exhibited at an elevation of 51 feet (15m5) from a white masonry tower, 29 feet (8m8) in height, situated on the bastion of the fort on the southern side of the entrance to Rio Damānganga.

Leading lights are exhibited from posts on the northern side of the river entrance; the front light, at an elevation of 8 feet (2m4), is situated on a bridge, and the rear light, at an elevation of 38 feet (11m6), on a quay; these lights in line lead over the bar.

Anchorage.—Directions.—Vessels may obtain anchorage about 4 miles westward of Damān lighthouse in a depth of 5 fathoms (9m1). Vessels, not exceeding 500 tons, sometimes enter Rio Damānganga at high water, in fine weather, and moor abreast the forts. A vessel making the river entrance should keep it open, bearing about 090°, and steer in on this bearing, anchoring in mid-channel abreast the forts. Local knowledge is necessary.

Coast.—Dangers.—Along the southern part of the coast of Surat district, which is situated northward of Rio Damānganga, there are small hillocks of drifted sand, and the coast in some parts is watered by springs, and covered with a thick growth of creepers and date palms. Through the river mouths and creeks the tide runs up behind the sandhills, and floods a large area of salt marshes. The rise of the tide renders these creeks and rivers accessible at high water, but local knowledge is necessary. In the northern part of the district there is an alluvial belt through which Tapti river forms a deep and fertile delta.

A 5½-fathom (10m1) shoal is situated about 5½ miles west-north-westward of the lighthouse at Damān (*Lat. 20° 24′ N., Long. 72° 49′ E.*) and about 4¾ miles offshore; another 5½-fathom (10m1) shoal lies about 9 miles north-westward of the same lighthouse and about 7½ miles offshore.

Pār river flows into the sea through Umaradi creek, about 8¼ miles

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Chart 735.

north-north-eastward of the entrance to Rio Damānganga; the bar at the entrance to this creek dries, and there are depths of less than one fathom (1m8) for a distance of about 2 miles westward of the entrance to the river.

Párnera hill, situated about 3½ miles eastward of the entrance to Umaradi creek, is 605 feet (184m4) high and has a fort on it.

Shoals, with a depth of 1¾ fathoms (3m2) and a least depth of 3¼ fathoms (5m9), lie about 4½ miles west-south-westward and 8½ miles west-north-westward, respectively, of the entrance to Umaradi creek.

Shoals, with a depth of less than 6 feet (1m8) of water over each, lie about 3½ miles offshore and 4 and 5½ miles, respectively, north-westward of the entrance to Umaradi creek.

Storm warnings.—Storm warnings are received at Kolak (Koluck), a village about 3¾ miles north-north-eastward of Damān, but no signals are hoisted. *See* page 20.

Outlying dangers.—A narrow bank, the southern end of which is situated about 15 miles west-north-westward of Damão lighthouse, extends for about 6¾ miles in a north-north-easterly direction, and has a least depth of 7 fathoms (12m8).

Malacca banks, lying further north-westward, are described on page 262.

Anchorage.—Directions.—Local knowledge is necessary for entering Umaradi creek, but in case of emergency, the following directions may be useful:—A vessel should keep in depths exceeding 3 fathoms (5m5) until a high white building at Párdi (*Lat. 20° 31′ N., Long. 72° 56′ E.*), a town about 3 miles east-south-eastward of the entrance to Umaradi creek, bears less than 112°, when they can steer in with the entrance of the river open. When Párnera hill bears 079° a vessel will be within the bar, and may anchor when the land northward is shut in behind the northern entrance point of the creek.

Auranga river.—Light.—Anchorage.—Auranga river flows into the head of Bulsar Khari, a creek about 5¼ miles northward of the entrance to Umaradi creek.

A light, known as Bulsar Khari, is periodically exhibited, at an elevation of 58 feet (17m7), from a wooden mast, 62 feet (18m9) in height, situated on the southern entrance point of Bulsar Khari.

Bulsar Khari creek is fronted by an extensive flat of mud and sand, which dries and extends about three-quarters of a mile to seaward of the entrance to the creek. Vessels can only cross the flat at about high water.

The entrance to Auranga river nearly dries, but within there are depths of from 7 to 9 feet (2m1 to 2m7).

A large vessel can anchor about 8½ miles westward of the entrance to Bulsar Khari in depths of from 5 to 6 fathoms (9m1 to 11m0).

The town of Bulsar, which is connected with the general railway system, lies about 3 miles east-south-eastward of Bulsar Khari light. In 1951, it had a population of 25,440.

Tithal village stands on the coast about 2 miles south-south-eastward of the same light.

Tidal stream.—The flood stream in the roadstead abreast the entrance to Bulsar Khari sets for one hour after the time of high water in the estuary.

Charts 2736, 826, 1012, 748b.

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Chart 735.

Storm warnings.—Storm warnings are received at Bulsar but no signals are hoisted. *See* page 23.

Coast.—There are some hills, about 100 feet (30^{m}5) high, about 5½ miles north-eastward of Bulsar Khari light-structure and about 5 miles inland.

Ambika river, the entrance to which is situated about 7½ miles north-north-westward of Bulsar Khari is fronted by a bar, with depths of from one to 2 feet (0^{m}3 to 0^{m}6), which extends about one mile offshore; on the north-eastern side of the entrance to the river there is a large tree.

Kanái creek is situated just northward of the entrance to Ambika river.

A tomb (*Lat. 20° 53′ N., Long. 72° 47′ E.*), with a white dome stands near the coast about 5 miles north-north-westward of the entrance to Kanái creek; it is prominent amongst the dark green trees, especially when seen from the south-westward.

Purna river, the entrance to which lies about 7 miles north-north-westward of Kanái creek, is difficult of access, on account of the winding channel among the sandbanks, in which there is generally a depth of from 3 to 4 feet (0^{m}9 to 1^{m}2). The river is navigable by large native craft as far as the towns of Navsári and Jalālpur, which are situated on the left bank, about 12 miles from the entrance, but it should not be attempted without local knowledge.

Between the entrance to Purna river and the entrance to Mindhola river, about 7¾ miles north-north-westward, there is a low plain of sand with some scattered palmyra trees.

Bhimpur is a small town situated on the northern side of the entrance to Mindhola river.

Charts 735, 51.

Dumas village, about 2 miles north-westward of Bhimpur, lies on the eastern side of the entrance to Tapti river. It is the marine sanatorium of Surat, and contains several bungalows among the coconut trees.

Tapti river.—Light.—Caution.—The entrance to Tapti river lies between the northern entrance point of Mindhola river and Suváli point (*Lat. 21° 05′ N., Long. 72° 37′ E.*), about 3½ miles westward.

A light, called Tapti light, is exhibited at an elevation of 91 feet (27^{m}7), from a white circular stone column, 90 feet (27^{m}4) in height, situated on Suváli point.

The position of Tapti light, on chart 51, is about three-quarters of a mile eastward of its true position.

Vaux's tomb stands close south-eastward of Tapti light-structure.

Chart 51.

Tapti river is about 450 miles long and tidal for a distance of 32 miles; small native craft can ascend the river to Surat city, 14 miles from the entrance, and boats at times go as far as Amroli, 11 miles above the city.

The river and its entrance are encumbered with numerous sandbanks, several of which dry; a vessel of 6 feet (1^{m}8) draught can only navigate in the river at more than half-tide.

Directions for entering Tapti river cannot be given, as the sands and channels are continually altering; the navigable channel can only be pointed out by the local pilots. The bar dries, but there is a spring

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Chart 51.

rise of about 20 feet (6m1), and off Surat city there is a pool with depths of from 2 to 3 fathoms (3m7 to 5m5).

Chart 735.

Surat roads.—Anchorage.—Cautions.—Surat roads is the name given to the anchorage off the entrance to Tapti river about 4 miles southward of Tapti light-structure.

In 1959, the 3-fathom (5m5) line about 7 miles south-south-eastward of Tapti light-structure was reported to be extending westward. Vessels should therefore approach Surat roads with caution.

It should be remembered that entry into Tapti river is not possible without the aid of a local pilot.

Charts 51, 735.

In Surat roads, and at the entrance of the Gulf of Cambay, southerly winds and unsettled weather, preceding the setting in of the south-west monsoon, begin earlier than at Bombay.

After the middle of April, and early in May, strong southerly winds frequently blow during the springs, causing a considerable sea and rendering anchorage unsuitable.

The approach of a gale during this period is sometimes indicated by dark cloudy weather, gloomy and black to the south-eastward, with lightning and faint variable breezes, mostly from southward. Under these conditions the anchorage off Gogha (page 268) is to be preferred, as it affords shelter from southward under the reef and island of Piram (*Lat. 21° 35′ N., Long. 72° 20′ E.*).

Chart 735.

Tidal streams.—The flood stream sets northward, and continues to set for one hour after the time of high water. At the outer anchorage during springs the tidal streams are very strong, especially the ebb, which sets southward at the rate of from 4 to 5 knots; nearer the bar the tidal streams are weaker. The tide frequently falls more than 6 feet (1m8) before the tidal stream turns southward.

Directions.—A vessel from the southward bound for Surat roads should, from abreast Damān, shape course for the roads, keeping in depths of from 5 to 10 fathoms (9m1 to 18m3), and being careful to avoid the 3¼-fathom (5m9) shoal (page 259), 8½ miles west-north-westward of the entrance to Umaradi creek.

Chart 51.

Surat city.—Surat city, the headquarters of Surat district, is situated on a bend on the eastern bank of Tapti river, and extends about 1½ miles along the river front; the castle, a mass of irregular fortifications flanked at each corner by large round towers, stands in the centre. The tombs of early European residents, including those of the Dutch, and the more modern ones of the Mullas of the Bohras, form the most interesting objects in Surat. A magnificent iron girder bridge crosses the river at the city.

The city, which, in 1951, had a population of 223,182, is connected with the general railway system.

Storm warnings.—Storm warnings are received at Surat but no signals are hoisted. *See* page 23.

Climatic table.—*See* page 53.

Chart 2736.

GULF OF CAMBAY.—General remarks.—The Gulf of Cambay

Charts 826, 1012, 748b.

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Chart 2736.

lies between the coast of Surat and Broach districts, eastward, and the eastern side of the peninsula of Kāthiāwār; it is entered between Suváli point and Gopnáth point, about 30 miles west-north-westward.

Malacca banks, described below, lie in the fairway of the approach, but there are deep channels eastward and westward of them; Sutherland and Grant channels are safer to use than the channels between these banks, as objects on the coast enable the position of a vessel to be accurately fixed. Sutherland channel should however only be used by those possessing local knowledge.

The southern part of the gulf is deep, but the northern part is much encumbered with sandbanks, which frequently change on account of the force of the bores and freshets out of the rivers.

Deep draught vessels can proceed up the gulf as far as Piram island (page 267); local knowledge is necessary for vessels navigating above Gogha (page 268).

Charts 51, 735, 2736.

Malacca banks.—Malacca banks is the general name for four long narrow shoals lying in and obstructing the entrance to the Gulf of Cambay between the parallels of 20° 20′ N. and 21° 15′ N.; these shoals, named in order from the eastward, are called Eastern bank, Breaker bank, Narbada bank and Western bank.

There are deep channels between these shoals, but they are narrow at their northern ends and it is inexpedient to use them.

Eastern bank has several shoal patches on it, some of which dry; as there is very deep water within 2 cables of these shoal patches, in many places, soundings give little warning of near approach to these dangers.

Sutherland channel, between Eastern bank and the mainland eastward, is about 2½ miles wide at its narrowest point, west-north-westward of Suváli point.

A sandbank on Breaker bank extends about 9½ miles northward from a position 22 miles south-westward of Suváli point (*Lat. 21° 05′N., Long. 72° 37′ E.*); it may be seen from the masthead from a long distance when the sun shines on it, at high-water neap tides, but it is submerged at high-water springs.

Narbada bank has a large extent of drying sand near its centre.

Western bank dries in places.

Grant channel, between Western bank and the Kāthiāwār coast, is steep-to on both sides, with general depths of from 8 to 10 fathoms (14^{m}6 to 18^{m}3), sand bottom towards the bank, and mud towards the coast.

Cautions.—The head or northern limit of Malacca banks should not be approached with an ebb tide as it is nearly steep-to and the soundings may not give sufficient warning; also it has not been closely examined.

In 1954, considerable shoaling was reported in the entrance to the Gulf of Cambay in the vicinity of the northern end of Narbada bank, a depth of 2 fathoms (3^{m}7) being found about 16½ miles east-north-eastward of Gopnáth light and about 2 miles north-north-westward of the northern extremity of Narbada bank, as defined by the 10-fathom (18^{m}3) line.

The sands and banks in the upper part of the Gulf of Cambay are subject to great alterations; any directions for its navigation must therefore be considered as general only.

Charts 826, 1012, 748b.

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Charts 51, 735, 2736.

The area in the vicinity of, and northward of, Mal bank (page 272) is based on a very old survey; implicit reliance should not be placed on the charted depths.

Chart 51.

EASTERN SIDE OF GULF.—Coast.—Dangers.—Light.—From Suváli point (*Lat. 21° 05′ N., Long. 72° 38′ E.*) the coast trends north-north-westward for about 7 miles to the entrance to Tena creek; it is fringed by the coastal bank, which dries and extends about one mile offshore, westward of Suváli point.

About 5 miles northward of Suváli point there are some sandhills, known as Suváli hills.

Westward of Suváli hills, Suváli bank, which dries, extends about 2 miles offshore; this bank consists of sand at its edge, with mud towards high-water mark.

Tena creek leads into Tapti river.

Between the entrance to Tena creek and the entrance to Sena river, about 9 miles northward, the coast is fringed with thick groves of palmyra trees, but between the entrance to Sena river and Luhara point, about 18½ miles further northward, it is low and marshy, intersected by several creeks and at spring tides is flooded from one to 4 miles inland.

A light is exhibited, at an elevation of 82 feet (25^{m}0), from a steel framework structure, 86 feet (26^{m}2) in height, situated on the coast about 2¼ miles south-eastward of the entrance to Sena river. It has been reported that this light-structure could not be identified from a distance of about 7 miles under favourable conditions.

Kim river, the entrance to which lies about 2 miles northward of the entrance to Sena river, dries at its entrance.

Between the entrance to Tena creek and the southern entrance point of Kim river a long narrow bank extends nearly parallel with the shore leaving a narrow channel between it and the coastal bank; the southern part of this bank, known as Tena bank, dries, and the northern part, called Outer Bhagwa sand, dries in patches.

Bhagwa channel, the channel inshore of Tena bank and Outer Bhagwa sand, is only used by small vessels with local knowledge; its continuation southward leads over a flat, with depths of not more than 6 feet (1^{m}8).

Gulwala bank extends about 6¼ miles southward from a position about 3½ miles westward of the southern entrance point of Kim river; it has depths of less than 6 fathoms (11^{m}0) and dries about 1¾ miles southward of its northern extremity.

Between Gulwala bank, westward, and Tena bank and Outer Bhagwa sand, eastward, there are several shoals with depths of one to 3 fathoms (1^{m}8 to 5^{m}5), as indicated on the chart.

The intricate navigation eastward of Gulwala bank, with its rapid tides, should not be attempted without local knowledge; at night, or in a large vessel, it is necessary to keep well westward of Gulwala bank.

Narmada (Narbadā) river flows into the Gulf of Cambay southward of Luhara point (*Lat. 21° 39′ N., Long. 72° 33′ E.*) through a wide estuary in which there are extensive sandbanks, which dry and are subject to change. The river itself also contains many sandbanks with channels between them, which are mostly shallow and very intricate.

Charts 2736, 826, 1012, 748b.

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Chart 51.

Tidal streams.—The tidal streams on the eastern side of the Gulf of Cambay set in a north by east direction with the flood tide, and in a south by west direction with the ebb, except when their direction is altered by the sandbanks.

Broach roads.—Light.—Dangers.—Buoy.—Broach roads is the roadstead westward of the entrance to Narmada river. There is regular communication by sea with Bombay and Bhavnagar (Bhaunagar).

Luhara point, the northern entrance point of Narmada river, is the highest ground in the vicinity; the land is generally low, and consists of sandhills covered with trees; the highest sandhill is just within Luhara point, and is about 80 feet (24m4) high.

A light is periodically exhibited, at an elevation of 30 feet (9m1), from an iron structure, 28 feet (8m5) in height, situated on Luhara point. *See* view [24].

The village of Luhara lies about one mile north-north-eastward of Luhara Point lighthouse.

The coastal bank, which dries, extends about 2½ miles south-south-westward and about 1¼ miles westward from Luhara point. Bar sands, situated close southward of the southern edge of the coastal bank, dry, and are marked on their western side by a red conical buoy.

Anchorage.—Tidal streams.—The anchorage in Broach roads is about 2 cables south-westward of the buoy marking Bar sands, with Luhara Point lighthouse bearing about 028°, distant 3¼ miles, and Piram Island lighthouse (page 267) bearing about 265°, in a depth of 9 fathoms (16m5), sand and mud, good holding ground. The anchorage is unprotected.

The flood tidal stream sets in a northerly direction at the anchorage, and flows for about one hour after the time of high water; the ebb stream sets in a southerly direction.

Narmada river.—Narmada (Narbadā) river can only be navigated by vessels drawing more than 6 feet (1m8) between half flood and half ebb, and then only if possessing local knowledge. The river is tidal as far as Ratnapur, a distance of about 55 miles.

Pilots for the river can generally be obtained off the bar of the river.

Kerselea bank, on the northern side of the estuary, is an extensive bank of mud and sand, which dries from one to 18 feet (0m3 to 5m5).

Alia bet, the western extremity of which is situated about 3¾ miles south-eastward of Luhara Point lighthouse (*Lat. 21° 39′ N., Long. 72° 33′ E.*), is an extensive island lying in the centre of the estuary; it is low-lying and covered with small scrub.

Broach channel, the principal entrance to the estuary, leads in westward and northward of Kerselea bank. A vessel can pass either southward or northward of Bar sands; the northern passage has a least depth of 6 feet (1m8). Within the bar it is comparatively deep as far eastward as Ambheta, a village about 3¼ miles north-eastward of Luhara Point lighthouse; above Ambheta the channel is shallow and intricate.

Charts 51, 2736.

Tidal streams.—The flood stream entering the river flows for about one hour after the time of high water, and sometimes attains a rate of from 5 to 6 knots. The ebb stream sets out strongly and runs occasionally for one hour after the time of low water. In the upper reaches near Broach, about 30 miles from the entrance, the flood stream

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Charts 51, 2736.

makes for only 3 hours and the ebb stream for 9 hours. During the flood tide there are heavy overfalls on the outer edge of the bar.

Broach.—The town of Broach, which is the headquarters of Broach district, is situated on the northern bank of Narmada river. In 1951, it had a population of 62,729.

The river face of the city wall is from 30 to 40 feet (9^m1 to 12^m2) high, and extends for about one mile along the bank. There is a civil hospital at Broach.

The town is connected with the railway system and a coasting trade is carried on by native craft with ports on the west coast of India.

Storm warnings.—Storm warnings are received at Broach but no signals are hoisted. *See* page 23.

Chart 51.

Coast.—Dangers.—Light.—From Luhara point (*Lat. 21° 39′ N., Long. 72° 33′ E.*) the coast trends northward for about $4\frac{1}{2}$ miles to the entrance to Bán creek, and consists of moderately high sandhills; thence it has a north-north-easterly direction for about $7\frac{1}{2}$ miles to the entrance to Dhādar river, is low-lying and composed of sand and mud.

Dehej, about $2\frac{3}{4}$ miles east-south-eastward of the entrance to Bán creek, and Gandhār, about 11 miles north-north-eastward of Dehej, are the only large villages near the coast; both have prominent buildings, which can be seen from a considerable distance.

Between Luhara point and the southern entrance point of Dhādar river a drying flat extends from about one to 3 miles offshore; the southern part of this drying flat is steep-to at its western edge.

A light, known as Devjagan light, is periodically exhibited, at an elevation of 41 feet (12^m5), from a circular stone column, 44 feet (13^m4) in height, situated on Tankari point, the northern entrance point to Dhādar river.

Devjagan pagoda stands on the same point about half a mile north-westward of the light-structure.

Dhādar river.—Dhādar river, which rises in the western spurs of the Vindhya mountains, is about 70 miles long and about $3\frac{1}{2}$ miles wide at its entrance. The channel leading into the river through the sand-banks, which extend from the shores on either side, lies about 2 miles southward of Tankari Point light-structure; it is very narrow, and has depths of from one to 9 feet (0^m3 to 2^m7) in the fairway, and about $1\frac{1}{2}$ miles within the entrance it nearly dries. Local knowledge is necessary for a vessel entering Dhādar river.

Tankāriā is a small town and port, situated on the eastern side of a small creek, which branches off from the northern side of Dhādar river, about $6\frac{1}{2}$ miles east-north-eastward of Tankari Point light-structure; this creek is only navigable by small native craft. There is a custom house just within the entrance to the creek on its eastern side.

Off-lying dangers.—Makra bank, the south-eastern extremity of which is situated about 6 miles north-westward of Luhara point and about 4 miles offshore, is a narrow shoal extending about $10\frac{1}{4}$ miles in a northerly direction; it dries near its centre.

Dehejbara shoal, the southern end of which lies about 6 miles north-north-westward of Luhara Point lighthouse and about 3 miles offshore, has a least depth of 3 fathoms (5^m5); there are depths of from 9 to 11 fathoms (16^m5 to 20^m1) in the channel eastward of the southern end of Dehejbara shoal, but this channel shoals further northward.

Charts 826, 1012, 748b.

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Chart 51.

A shoal, with a least depth of 2½ fathoms (4m6), and a detached 3-fathom (5m5) patch lie about one mile eastward of the northern part of Makra bank.

See caution on page 262 regarding alterations to banks in the upper part of the Gulf of Cambay.

Tidal streams.—*See* page 264.

Tankari road. — Anchorage. — Caution. — Tidal streams. — The roadstead off the entrance to Dhādar river is called Tankari road; it can be identified by the lighthouse and Devjagan pagoda on Tankari point.

A vessel may anchor with the lighthouse bearing 047°, distant about 3¾ miles, and the buildings at Gandhār bearing 086°, but *see* caution on page 262.

The flood tidal stream in Tankari road continues to run for one hour after the time of high water; the greatest rate of the tidal streams in the roadstead at springs is 6 knots.

WESTERN SIDE OF GULF.—Coast.—Dangers.—Lights.—Beacon.—Light-buoy.—From Gopnáth point (*Lat. 21° 12′ N., Long. 72° 07′ E.*) the coast has a general north-north-easterly direction for about 18½ miles to Mitivirdi, a small village on the coast, and is low and fringed with sandhills; thence it trends in a similar direction for about 9½ miles to Kuda point, and is comparatively high, with several ravines close to the coast. The country is flat and cultivated, with many scattered villages mostly surrounded by trees; inland it is generally from 100 to 200 feet (30m5 to 61m0) high.

The coast is mostly fringed with reef, which extends about one mile offshore in places.

Gopnáth point is moderately high, and has on it a conspicuous lighthouse and bungalow ; about three-quarters of a mile northward of the point there is a temple, 75 feet (22m9) high.

A light is exhibited, at an elevation of 68 feet (20m7), from a buff-coloured tower, 32 feet (9m8) in height, situated on a hillock about 1¼ cables within Gopnáth point. *See* view [25].

Gopnáth shoal, a reef which dries in places, extends about 3¾ miles north-eastward from Gopnáth point; it is nearly steep-to on its eastern side.

Shetrunji river flows into the Gulf of Cambay through two mouths, about 4¼ and 6 miles, respectively, northward of Gopnáth point; the coastal reef dries to a distance of about 1½ miles offshore eastward of the mouths of this river.

Saltánpur is a small port on the coast, about three-quarters of a mile within the northern entrance of Shetrunji river.

Talája hill, about 10 miles north-north-westward of Gopnáth point and about 5 miles inland, is a steep conical hill, about 370 feet (112m8) high, rising from a level plain; on its summit there is a conspicuous Hindu temple.

Saltánpur shoal extends about 3 miles north-north-eastward from a position about 6 miles north-eastward of Gopnáth point; it lies about 4¼ miles offshore, consists of rock, sand and clay and dries 3 feet (0m9). There is shoal water between Gopnáth and Saltánpur shoals.

A red can light-and-bell-buoy, exhibiting a *red flashing* light *every*

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Chart 51.

five seconds is moored about one mile off the eastern side of Saltánpur shoal about 8¼ miles north-eastward of Gopnáth point.

Talája hill, bearing less than 277°, leads northward of Saltánpur shoal.

At about 8 miles northward of Gopnáth Point lighthouse, the coastal reef extends about 1¾ miles offshore, and about 8 miles north-north-eastward of the same lighthouse are two detached shoals, with depths of less than 6 feet (1m8).

A light is exhibited, at an elevation of 125 feet (38m1), from a white steel framework tower, 45 feet (13m7) in height, situated close southward of Mitivirdi.

Chart 2736.

Palitana mountain, about 12 miles west-north-westward of Talája hill, is 1,957 feet (596m5) high and conspicuous.

Chart 51.

A range of hills, called the Khokhra hills, the southern end of which is situated about 9½ miles north-north-eastward of Talája hill, extends about 7½ miles in a northerly direction; its summit, 985 feet (300m2) high, which is near the northern end of the range, is conspicuous.

Chart 1035.

Kuda point, 33 feet (10m1) high, has on it a thick clump of trees, prominent from the northward or southward, and a white bungalow which shows well during the forenoon when seen from the eastward.

Foul ground and shoal water extend about 2¼ miles south-eastward, 1¾ miles eastward, and 2½ miles north-eastward from Kuda point.

Mallock reef lies about 1½ miles south-eastward of Kuda point on the western side of the channel between it and the reef extending north-westward from Piram island.

Nakalang Mahādev beacon (*Lat. 21° 36′ N., Long. 72° 17′ E.*) is situated on the coastal reef, about 2¼ miles south-south-westward of Kuda point.

Charts 1035, 51.

Piram island.—Light.—Piram island, 37 feet (11m3) high, the northern end of which is situated about 2¾ miles east-south-eastward of Kuda point, is composed of sand; it is surrounded by a reef which extends about 2¼ miles northward and north-eastward, one mile eastward, 1½ miles southward and three-quarters of a mile westward, from the island; shoal water, with depths of less than 6 fathoms (11m0), extends about 7¾ miles south-south-westward from the southern end of Piram Island reef.

A light is exhibited, at an elevation of 128 feet (39m0), from a white circular tower, 75 feet (22m9) in height, situated on the ruins of the old bastion near the middle of Piram island. The lighthouse is conspicuous. *See* view [26].

Chart 1035.

At the southern end of the island there are a few trees and a little cultivation, and the north-eastern side is fringed by a few mangrove trees. There is a small village close northward of the lighthouse.

The best landing place is on the western side, near the northern point of the island.

The narrow channel between Mallock reef and Piram island should not be used without local knowledge, as the tides run through at a great rate, and there is very little slack water.

Charts 826, 1012, 748b.

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Chart 1035.

Tidal streams.—Within Gopnáth and Saltánpur shoals the flood stream at springs does not turn for more than one hour after the time of high water, and the ebb stream continues to run for more than 1½ hours after the tide has commenced rising; at neaps the flood stream turns 2 hours after the time of high water.

Anchorage.—A small vessel can obtain anchorage between Saltánpur shoal and the coast in depths of from 2½ to 3 fathoms (4m6 to 5m5), but local knowledge is essential.

Coast.—Dangers.—Lights.—From Kuda point the coast trends north-north-westward for about 4 miles to Gogha and is low and marshy; it is fronted by reefs, parts of which dry, and shoal water which extends nearly 2½ miles offshore; abreast Gogha the foreshore is mud and shingle, and dries out for about 4½ cables.

Gogha is a walled town; at its northern end there is a small creek, which dries, and a custom-house bandar where the native trading craft lie in safety. An iron light-structure and flagstaff stand on the southern entrance point of the creek. The land in the vicinity of Gogha is inundated at spring tides.

A light is exhibited, at an elevation of 25 feet (7m6), from the iron structure, 27 feet (8m2) in height, on Gogha bandar.

From Gogha (*Lat. 21° 41′ N., Long. 72° 16′ E.*), the coast trends north-north-westward for about 5¾ miles to Ruvapari light-hut, and thence north-westward for about 3 miles to Bhavnagar (Bhaunagar) point, the western entrance point of Bhavnagar (Bhaunagar) creek; it consists of a mud flat, overgrown by low mangrove bushes, and intersected by numerous small creeks which dry.

A light is exhibited, at an elevation of 26 feet (7m9), from a tide guage, 14 feet (4m3) in height, situated about 3 cables offshore about 2½ miles north-north-westward of Gogha light-structure.

Bhavnagar New port (page 270) is situated in an inlet about 5 miles north-north-westward of Gogha light-structure.

A light is exhibited, at an elevation of 52 feet (15m8), from a grey hut on piles, situated on the south-western side of Bhavnagar channel, about 5¾ miles north-north-westward of Gogha light; this light is called Ruvapari light. *See* view [27].

A disused lighthouse stands in the mud about one cable north-eastward of Ruvapari light-hut.

The whole area westward of Channel bank (*see* below) and a line drawn from its southern end to a position 3½ miles south-eastward of it, is shoal, with depths of less than 3 fathoms (5m5). The channel south-westward of Channel bank is called Bhavnagar (Bhaunagar) channel.

A light is exhibited from a grey hut on piles situated on Bhavnagar point.

A light is exhibited, at an elevation of 36 feet (11m0), from a round concrete tower, painted black and white in bands and 41 feet (12m5) in height, situated on Johnston point, about 1¼ miles east-south-eastward of Bhavnagar point.

Bhavnagar creek (page 270) is entered between Bhavnagar and Johnston points.

Off-lying dangers.—Light-vessel.—A shoal, with a least depth of 29 feet (8m8), lies about 5 miles east-north-eastward of Kuda point and about 4½ miles from Piram island.

Charts 51, 2736, 826, 1012, 748b.

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Chart 1035.

An obstruction was reported, in 1939, to lie about 4½ miles north-eastward of Kuda point.

A shoal, with a least depth of 17 feet (5m2), is situated about 4¾ miles north-north-eastward of Kuda point.

Perigee rock, about 2¼ miles north-eastward of Gogha light-structure, dries 4 feet (1m2); it shows three heads above water at the lowest spring tides.

A light-vessel, painted black, is moored about 2½ cables south-eastward of Perigee rock.

Between Perigee rock and the 17-foot (5m2) shoal mentioned above the depths are irregular; this area has not been closely examined.

Southern patch, situated about 6½ miles east-north-eastward of Gogha light-structure, dries 3 feet (0m9).

A shoal, the southern end of which lies about 3¾ miles north-eastward of Gogha light-structure, extends about 3¼ miles in a north-north-westerly direction, and dries 4 feet (1m2).

Charts 1035, 51.

Channel bank, the southern end of which lies about 2¾ miles north-north-eastward of Gogha light-structure (*Lat. 21° 41′ N., Long. 72° 16′ E.*), extends in a northerly direction for about 5½ miles, and dries 13 feet (4m0); it is covered with grass.

The channel eastward of Channel bank is called Malcolm channel; eastward of Malcolm channel are several shoals, but this latter area has not been examined.

Channel bank is joined north-westward to Johnston point by Entrance bank, which dries from one to 26 feet (0m3 to 7m9).

Rogno Bhato or Rhook (Rhuk) bank, the southern extremity of which lies about 1½ miles north-north-eastward of Ruvapari light-hut, extends in a northerly direction for about 10 miles to abreast Sonrai creek; this bank partially covers at high-water springs, and is covered with mangrove bushes. Its southern extremity is known as Howarth point.

The channel between the north-western side of Channel bank and the south-eastern side of Rogno Bhato bank is called Nares channel.

Chart 1035.

Tidal streams.—The time of high water at Gogha is the same as that at Ruvapari light-hut, but 22 minutes earlier than the time of high water at Bhavnagar. The direction and rate of the tidal streams are affected by local winds, especially in Malcolm channel. At the southern end of Channel bank the tidal streams divide, and are irregular. At the northern end of Bhavnagar channel the flood and ebb streams have a rate of about 3 knots at spring tides and 2½ knots at neap tides; these rates are liable to be increased when freshets occur in Bhavnagar creek. The general direction of the tidal streams is parallel to the coast. The duration of slack water at the northern end of Bhavnagar channel varies from 13 to 20 minutes at spring tides and from 12 to 22 minutes at neap tides.

Anchorage.—Anchorage may be obtained off Gogha roads in a depth of 6 fathoms (11m0), with Gogha light-structure (*Lat. 21° 41′ N., Long. 72° 16′ E.*) bearing 255°, distant 2½ miles; the depth decreases rapidly inshore of this position. The holding ground is good, being a mixture of stiff mud and sand, but owing to the exposed position of the anchorage and the irregularity of the tidal streams in the neighbour-

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Chart 1035.

hood, vessels at anchor yaw considerably, and with a moderate wind experience a short choppy sea; under these conditions it may be difficult for a vessel to work cargo.

Bhavnagar New port.—Lights.—Wharf.—Bhavnagar New port, on the western side of Bhavnagar channel, is situated near the head of an inlet which mostly dries; the mouth of the inlet is situated about 5 miles north-north-westward of Gogha light-structure.

Leading lights, about half a mile apart, are exhibited from the head of the inlet; in line, bearing 251½°, they lead through a dredged channel to the turning basin off the wharf.

There is a concrete wharf, 882 feet (268m8) in length, on the southern side of the inlet near its head; a depth of 20 feet (6m1) is maintained alongside as far as possible by dredging; the bottom is soft mud. The wharf can accommodate two vessels of up to about 420 feet (128m0) in length; the permissible draught varies between 22 and 28 feet (6m7 and 8m5), depending on the height of the tide.

Vessels arrive and depart at about high slack water. They enter with a tug ahead and another is available in the turning basin, where they are usually swung and berthed starboard side to the wharf.

There is a steel jetty, 240 feet (73m1) in length, for the use of coasters, lighters and sailing vessels.

Pilotage.—Pilotage is compulsory for merchant vessels bound for Bharvnagar New port. Vessels should arrive in a position 5 miles north-eastward of Piram Island lighthouse not later than 2½ hours before the time of high water at Bhavnagar for docking on the same tide. Previous notice of the expected time of arrival at the above position is necessary to obtain a pilot.

The pilot vessel is a tug with a black hull, buff upperworks and a buff funnel with a black top; in addition to the usual signals for a pilot vessel a searchlight is flashed from time to time at night.

Anchorage.—Deep-draught vessels wishing to communicate with Bhavnagar or discharge cargo in the stream should anchor northward of Perigee rock; local knowledge is necessary.

Port facilities.—No bunkers are available. Fresh water can be obtained from hydrants on the concrete wharf or from a waterboat in the stream.

The concrete wharf is connected with the railway system of the old port; it has five storage sheds and 51 godowns.

There is a dry dock for port vessels and a well-equipped port workshop.

There are five 3-ton cranes on the concrete wharf, three 3-ton cranes on the steel jetty and one 5-ton crane at the dry dock.

Twelve 100-ton steel barges and four tugs are available.

Development of the port includes the provision, at the entrance to the inlet, of a lock gate which was due for completion in mid-1960. Ships will then be able to remain afloat at the concrete wharf at all times.

Shipping.—In 1958-59, 149 powered vessels and 2,128 sailing vessels with total net registered tonnages of 349,197 and 67,784, respectively, used the port (*Lat. 21° 46′ N., Long. 72° 14′ E.*).

Bhavnagar.—Trade.—Communications.—*See* page 272.

Chart 1035, with plan of Bhavnagar creek.

Bhavnagar creek.—Dangers.—Bhavnagar (Bhaunagar) creek,

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Chart 1035, with plan of Bhavnagar creek.

which is entered between Bhavnagar point (*Lat. 21° 49′ N., Long. 72° 12′ E.*) and Johnston point is a good and safe harbour for vessels of light draught; it is the estuary of Kálubhár river.

The country in the vicinity is low and level; the mud flats which fringe the coast are partly covered at high water.

A shoal, which dries from one to 8 feet (0^m3 to 2^m4), extends from the north-eastern shore, opposite Bhavnagar point, and reduces the channel to a width of about one cable.

Chart 1035, plan of Bhavnagar creek.

Point flat, immediately westward of Bhavnagar point, extends about 4¼ cables northward from the southern side of Bhavnagar creek, and dries from one to 21 feet (0^m3 to 6^m4); the channel north-westward of this flat is about three-quarters of a cable wide.

Lina flat, which dries from 4 to 17 feet (1^m2 to 5^m2), extends about 3 cables southward from the northern side of Bhavnagar creek, abreast Bhavnagar bandar, which is situated about 2½ miles west-south-westward of Bhavnagar point; the channel southward of this flat is about half a cable wide.

Lights.—Beacons.—The lights on Bhavnagar and Johnston points are described on page 268.

A light is exhibited, at an elevation of 30 feet (9^m1), about 7 cables north-north-westward of Bhavnagar point.

A light is exhibited, at an elevation of 30 feet (9^m1), about one mile west-south-westward of Bhavnagar point.

A light is exhibited, at an elevation of 43 feet (13^m1), from a tower situated on Bhavnagar bandar.

A beacon stands on Johnston point about one cable south-westward of the light-structure.

Five beacons, situated on the northern side of the creek north-north-westward of Bhavnagar point, form three pairs of leading marks to lead up to and round Point flat; a pair of beacons on the southern bank about 1½ miles above Bhavnagar point lead across the drying bank in mid-channel.

Pier.—Depths.—There is a steel pier, for the use of vessels working cargo, situated on the southern side of Bhavnagar creek; it is connected with the railway system; this pier is 240 feet (73^m1) long, and can handle coastal vessels of medium draught; three 3-ton and two 5-ton cranes are available. Vessels using this pier lie alongside with an anchor down; they can lie on the mud at low water.

In 1926, there were depths of 15 feet (4^m6) about 400 feet (121^m9) westward of Bhavnagar pier. At spring tides a vessel should be prepared to enter a mud tidal basin, which is kept dredged to a depth of 12 feet (3^m7); the bottom of the basin consists of very soft mud.

At neaps small vessels can lie at the buoys off the pier, moored fore and aft.

Directions.—Owing to the frequent changes in the banks and channels and to the fact that local knowledge is necessary, no directions will be given.

Caution.—Owing to silt, the depths in Bhavnagar creek and its approaches are liable to change, and the leading marks are liable to alteration. Dredging operations are constantly in progress.

Bhavnagar.—The city of Bhavnagar (Bhaunagar) is situated on the southern side of Bhavnagar creek, southward of Bhavnagar bandar.

Charts 51, 2736, 826, 1012, 748b.

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Chart 1035, plan of Bhavnagar creek.

The principal occupations are spinning and weaving of cotton yarn and piece-goods, furniture making, sugar and gur refining, cotton ginning and pressing and timber sawing.

In 1951, the population of the city was 137,951.

Port facilities.—Tugs and lighters are available for vessels working cargo in the stream.

In addition to the cranes on the pier there is a floating crane with a capacity of 6 tons.

Indian coal can be supplied, and water in small quantities. Provisions are obtainable, with the exception of beef and fish.

There is a well-equipped Government hospital with an ambulance in attendance day and night.

Communications.—There is regular communication by sea with Bombay. Bhavnagar is connected with the general railway system.

There is regular communication by air with Bombay, Rajkot, Jamnagar and Bhuj.

Storm signals.—There is a storm signal station at Bhavnagar; the brief system is used. *See* page 20.

Trade.—The principal imports are food grains and pulses, coal and coke, timber, cotton and cotton seed, mineral oils, hardware, iron and steel, sugar, coconuts, gunnies, betel nuts and tea.

Exports are salt, onions, ground-nut oil and seeds, vegetable oil, oil cake, bone meal and iron ore.

Chart 51.

HEAD OF GULF.—From Johnston point (*Lat. 21° 49′ N., Long. 72° 13′ E.*) the coast trends north-north-eastward for about 26 miles to the entrance to Dholera creek; it is composed chiefly of mangrove jungle, which extends several miles inland. The sandbank fronting the coast dries and extends from one to 4 miles offshore, forming the western side of Malcolm and Cambay channels.

Mal bank.—Channels.—Depths.—Mal bank, the southern edge of which is situated about 7½ miles eastward of Johnston point, is a large sandbank lying in the centre of the head of the Gulf of Cambay, and extending for about 14 miles in anortherly direction.

There are channels on either side of Mal bank, each about one mile wide in the fairway, but local knowledge is essential. *See* Caution on page 263. Malcolm channel, the western channel, had, in 1934, depths of from 6½ to 14 fathoms (11^{m}9 to 25^{m}6) in its southern part, but in its northern part, near the northern end of Mal bank, there were depths of 3½ fathoms (6^{m}4) in the fairway.

From the northern end of Mal bank Cambay channel has a north-easterly direction, and leads into the estuary of Mahi river, on the northern side of which stands the town of Cambay. The depths at the entrance of this channel are from 4 to 6 fathoms (7^{m}3 to 11^{m}0) in the fairway, decreasing to 1½ fathoms (2^{m}7) about 6½ miles below the town, but this information is old and cannot be relied upon; it is shoaler further up the river.

Bore rocks, situated about 6½ miles south-eastward of the entrance to Dholera creek, on the north-western side of Cambay channel, have depths of less than 6 feet (1^{m}8) over them. They lie on the northern side of the channel between the banks at the entrance to Sábarmati

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Chart 51.

river, which flows into the western side of the head of the Gulf of Cambay.

The channel leading close south-westward of Bore rocks nearly dries.

Mahi river, which is about 350 miles long, has its source in Mehad lake.

Dholera creek.—Dholera creek extends in a westerly direction on the western side of the entrance to Sábarmati river; Dholera, a large town, about 6 miles from the entrance of the creek, is one of the chief cotton marts in the Gulf of Cambay. Owing to the continued silting up of Sábarmati estuary, the shipping port of Dholera is at Whittle bandar, about 1½ miles from the entrance of Dholera creek and connected with the town of Dholera by a road. Native craft lie alongside the bank to work cargo.

Sábarmati river.—Sábarmati river, which is about 200 miles long, rises in the north-eastern part of Ahmedabad district, near the Aravalli range; it has several tributaries both above and below the city of Ahmedabad, which is on the left bank of the river, about 50 miles from the head of the gulf. The shores of the river are rather elevated and well cultivated.

Sikotar Máta (Singotir Mata) is a pagoda (*Lat. 22° 19′ N., Long. 72° 24′ E.*), 19 feet (5^{m}8) high, with a flagstaff, situated on the eastern entrance point of Sábarmati river.

Tidal streams.—In the upper part of the Gulf of Cambay the tidal streams set in a north-easterly direction with the flood into Mahi river, and in a south-westerly direction with the ebb, with a rate of from 4½ to 6 knots.

Tidal bores.—Tidal bores form near the entrance to Sábarmati river; one travels up that river while another travels up Cambay channel and Mahi river. Each sweeps through the channels as a line of disturbed and breaking water and tends to alter the configuration of those channels.

The bore in Mahi river may be as much as 8 feet (2^{m}4) in height and attain a rate of 10 knots at the highest spring tides. The magnitude of the bore varies with the range of the tide. At neap tides it is not perceptible but becomes increasingly prominent as spring tides approach. The bore preceding the higher high water is greater than that preceding the lower of two successive high waters.

The bore in Sábarmati river is similar but less pronounced.

The flood stream commences at a great rate with the passage of the bore, then diminishes, but three-quarters of an hour after the bore has passed has increased to its greater rate.

Cambay.—The town of Cambay lies at the head of the Gulf of Cambay about 12½ miles eastward of Sikotar Máta pagoda; in 1951, it had a population of 39,038.

Storm warnings.—Storm warnings are received at Cambay but no signals are hoisted. *See* page 23.

Chart 2736.

COAST.—General remarks.—Aspect.—The coast of Káthiáwár from Gopnáth point to the entrance to the Gulf of Kutch, about 190 miles west-north-westward or about 230 miles by sea, is composed chiefly of sandstone, with perpendicular cliffs and overhanging rocks

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Chart 2736.

in many parts. The surface of the country is undulating, and along the seaboard averages about 100 feet (30m5) high.

Gir hills, about 25 miles northward of Diu head (*Lat. 20° 41′ N., Long. 70° 50′ E.*), which is situated about 80 miles west-south-westward of Gopnáth point, extends about 40 miles in an easterly and westerly direction, and attains an elevation of 2,101 feet (640m4); these hills cannot be seen from any considerable distance from the south-westward, but Nándivela, 1,728 feet (526m7) high, its south-eastern peak, about 27 miles north-eastward of Diu head and about 15 miles inland, is conspicuous from the southward. *See* view on chart 50.

Gorakhnāth (Girnar), 3,662 feet (1,116m2) high, situated about 53 miles north-north-westward of Diu head and about 35 miles inland, is conical-shaped, and consists of an immense bare and isolated granite rock, upon which there are many temples and monasteries; it is prominent in clear weather from abreast Diu head to Porbandar, about 88 miles north-westward, but farther north-westward it is obscured by the Bārdā range, which is situated about 30 miles west-northwestward of Gorakhnāth mountain. *See* view [28].

Charts 51, 50.

Coast.—Dangers.—Lights.—From Gopnáth point the coast trends south-westward for about 21 miles to Mahuva bay; it is fringed by the coastal reef, which extends in places about three-quarters of a mile offshore.

Jhánjhmer is a walled town on the coast, about 2¾ miles west-south-westward of Gopnáth Point lighthouse; immediately southward of the town are the remains of an old fort, which is square and conspicuous; good landing can be effected in this vicinity near the time of high water. A light is exhibited from a red rectangular framework structure situated at the north-western corner of Jhánjhmer fort.

A projecting point, 90 feet (27m4) high, close inland of which is a tower, extends eastward from the coast, about midway between Gopnáth point and Jhánjhmer fort; Pinnacle rock lies close south-westward of this projecting point. There is a conspicuous tree about half a mile north-north-eastward of the tower mentioned above.

Bhensla rock, 80 feet (24m4) high, about 1¼ miles south-westward of Jhánjhmer, is a small rocky islet, lying on the drying coastal reef.

Methla point is a low rocky projection, 25 feet (7m6) high, about 2½ miles south-westward of Bhensla rock; northward of this point the land rises, attaining, about half a mile inland, the average elevation of the undulating land in this neighbourhood of rather more than 100 feet (30m5). Methla village lies about 1½ miles northward of the point.

Between Methla point and Kotada bluff, about 2 miles west-south-westward, is a sandy bay with a low coast. Bagad river, a small stream, flows into this bay about one mile west-north-westward of Methla point; near the time of high water it affords shelter to boats within its entrance, from easterly winds.

Kotada bluff is 80 feet (24m4) high; during westerly winds boats can land on the north-eastern side of the bluff.

Chart 50.

Another bluff, also 80 feet (24m4) high, is situated about 5¾ miles west-south-westward of Kotada bluff; the coastal reef, in the bay north-eastward of this bluff, covers at high water.

Charts 826, 1012, 748b.

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Charts 1779, plan of Mahuva bandar; 50.

Nikol bandar, a small indentation in the coast, about 7¾ miles west-south-westward of Kotada bluff, is almost blocked at low water by a ledge of drying rocks; within the entrance there is a large area of marshy ground which is submerged at high water. Only native boats frequent Nikol bandar, which is connected by a creek with Nikol, and with Vághnagar, a village about 2½ miles inland.

Chart 1779, plan of Mahuva bandar.

Cave point (*Lat. 21° 04′ N., Long. 71° 50′ E.*), about 6 cables west-south-westward of the western entrance point of Nikol bandar, is fringed by a ledge of rocks, which extends about one cable offshore.

Between Cave point and Jegri bluff, the south-eastern extremity of Jegri island, about 2¼ miles south-south-westward, is Jegri bay, a shallow bight, the head of which, consisting of sand and mud, dries out to a distance of about 6½ cables; the depths increase gradually to seaward. Jegri village is situated at the head of the bay, about 1¼ miles north-north-westward of Jegri bluff.

Jegri island, known locally as Katpur island, is sparsely cultivated, and has bold rocky cliffs on its eastern and southern sides, but its western part consists of sandhills from 60 to 75 feet (18m3 to 22m9) high. *See* view on plan.

A light is exhibited, at an elevation of 90 feet (27m4), from a white turret on the roof of a house, 27 feet (8m2) in height, situated on Jegri bluff. *See* view on plan.

A small temple on the summit of a sandhill, about three-quarters of a mile north-eastward of Jegri village, and the lighthouse on Jegri island are the most conspicuous marks on this part of the coast.

A reef, which dries, extends 2 cables eastward from Jegri bluff; around this reef the tides set with considerable strength, forming a race.

Eastward of the lighthouse on Jegri island are some rocky patches; the least depth found, 17 feet (5m2), is about 7 cables east-north-eastward of the lighthouse.

Tidal streams.—Southward and westward of Jegri island the tidal streams set in the direction of the line of coast, the flood eastward and the ebb westward, attaining at springs a rate of 2½ knots with the flood stream and of one knot with the ebb; off Jegri bluff the flood stream sets in a more northerly direction, but in Jegri bay is little felt. Strong eddies and a race form south-eastward of Jegri bluff at about high and low water.

Chart 50.

Anchorages.—Small vessels can obtain anchorage about 9 cables south-eastward of Jhánjhmer fort in a depth of 5½ fathoms (10m1), sand and mud.

Chart 1779, plan of Mahuva bandar.

A small vessel can obtain anchorage about 3¾ cables east-north-eastward of the lighthouse on Jegri bluff, with shelter from westerly winds, in charted depths of from 4 to 9 feet (1m2 to 2m7), mud. North-easterly winds blow in heavy squalls, causing a very considerable sea in Jegri bay.

Mahuva bay.—Dangers.—Beacon.—Mahuva bay is entered between the south-western extremity of Jegri island and a point about half a mile south-westward; it nearly dries, showing a mass of rocks and stones.

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Mahuva bandar.

The south-western extremity of Jegri island is a bluff point, 60 feet (18m3) high; the south-western entrance point is similar but 80 feet (24m4) high. *See* view on plan.

A reef, which dries, extends about 2½ cables east-north-eastward from the south-western entrance point; it is marked at its northern edge by a beacon; Dosi rock, lying on this reef, about 1¾ cables east-north-eastward of the south-western entrance point, is 4 feet (1m2) high.

About midway between Dosi rock and the south-western extremity of Jegri island are two rocks awash, and two sunken rocks, with depths of less than 6 feet (1m8) over them.

Anchorage.—A small vessel can obtain good anchorage with Jegri Bluff lighthouse (*Lat. 21° 02′ N., Long. 71° 48′ E.*) bearing 040°, distant about 6 cables, in a depth of about 7 fathoms (12m8), mud.

Mahuva bandar.—Mahuva bandar, situated about 9 cables north-north-westward of the south-western entrance point of Mahuva bay, is approached from the bay by a creek, which nearly dries; the bandar, which has a custom house, is connected with the general railway system. *Charts 1779, plan of Mahuva bandar; 50.*

Mahuva town.—Mahuva town, situated about 2¾ miles northward of Mahuva bandar, from which it is separated by an extensive swamp which is submerged at high water, is a walled town, with a prominent temple near its centre; there is a high and conspicuous chimney about one mile west-north-westward of the town.

There is regular communication by sea between Mahuva bay and Bombay, Bhavnagar and Jáfarabad during the north-east monsoon. *Chart 50.*

Coast.—Dangers.—The coast for about 2½ miles west-south-westward of the south-western entrance point of Mahuva bay is composed of limestone cliffs; it is fringed by a coastal reef, which extends about 1½ cables offshore and is steep-to.

Gadhada village, situated about 2 miles west-south-westward of the south-western entrance point of Mahuva bay, stands on the edge of a cliff, 65 feet (19m8) high.

The bight between Gadhada and Islet point, about 4 miles west-south-westward, is filled with a coastal reef, which extends in places about 1¼ miles offshore; there are sandhills, about 40 feet (12m2) high, on this part of the coast.

A detached 4-fathom (7m3) rocky shoal is situated about 3 miles south-westward of Gadhada and about 1¾ miles offshore. Tapon island stands on the coastal reef, about one mile north-north-westward of this rocky shoal.

Islet point, a prominent hilly point, is fronted by several islets, which are all connected with each other and with the coast by a drying reef of rocks. The southern islet, about three-quarters of a mile southward of this point, is 45 feet (13m7) high and nearly steep-to; a spit, with a depth of 13 feet (4m0) at its southern edge, extends about three-quarters of a mile east-south-eastward from this islet. The northern islet, known as Pauradhar islet, is 80 feet (23m4) high.

Between Islet point and a bluff point, 50 feet (15m2) high, about 2½ miles west-south-westward, is a shallow bay, most of which dries. Square rock, 15 feet (4m6) high, lies close eastward of the eastern extremity of this bluff.

Charts 2736, 826, 1012, 748b.

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Chart 50.

Anchorage.—The bay westward of Islet point affords shelter to small craft from easterly winds.

Charts 1779, plan of Port Albert Victor; 50.

Port Albert Victor and approaches.—Light.—Dangers.—Beacons.—Chánch island, the eastern extremity of which lies about half a mile westward of the 50-foot (15m2) bluff mentioned above, fronts the coast for about 4½ miles; there is an extensive mangrove swamp close inland, which is submerged only at very high spring tides.

Motapát creek, which separates the north-western and northern sides of Chánch island from the mainland, is the outlet for waters which cover an immense tract of marshy land at high water. It is fed by numerous small creeks, the principal of which is Devrápura creek. Port Albert Victor lies on the mainland abreast the northern extremity of Chánch island.

Chánch point projects southward near the centre of Chánch island and is about 80 feet (24m4) high. It has a village of the same name and a temple on it. A palace, about three-quarters of a mile west-south-westward of the temple, is a good landmark from south-eastward and southward. One Tree hill, at the western extremity of Chánch island, is 41 feet (12m5) high.

A light is exhibited, at an elevation of 100 feet (30m5), from a white masonry tower with a red band, 20 feet (6m1) in height, situated near the temple on Chánch point (*Lat. 20° 57′ N., Long. 71° 35′ E.*).

Chart 1779, plan of Port Albert Victor.

A reef, which dries 3 feet (0m9), extends about 3 cables west-south-westward from the western extremity of Chánch island; at the western edge of this reef stands a conspicuous circular tower, 21 feet (6m4) in height, which was the former tidal observatory.

From the south-western edge of this reef a flat, which dries one foot (0m3), and is known as Spit sand, extends about 1¾ miles south-westward; the south-western edge of Spit sand has a least depth of 5 feet (1m5), and is called The Spit.

Bhensla rock, 40 feet (12m2) high, is situated about 2 miles south-south-eastward of the western extremity of Chánch island; it is a bluff rocky islet, nearly steep-to on its eastern side; foul ground and shoal water extend about 2¾ cables westward from this islet; Sims rock, which dries one foot (0m3), is situated at the western edge of this foul area. There is shoal water extending from Bhensla rock to Chánch island northward.

Savai bet, the eastern extremity of which is situated about one mile south-westward of Bhensla rock, and on which there are two cairns, is a barren rocky islet, 64 feet (19m5) high; near the centre of this islet is a Mohammadan tomb, a small white domed building, which is conspicuous from seaward (*see* view B on chart 50). Savai bet reef extends about 4 cables eastward from the eastern extremity of Savai bet, and dries; the eastern edge of this reef is steep-to.

Shiyal bet, an islet, the south-eastern extremity of which is situated about one cable westward of Savai bet, with which it is connected by a drying reef, attains an elevation of 65 feet (19m8); on the highest part of this islet, about 2½ cables north-eastward of its south-western end, there is a conspicuous tower (*see* view B on chart 50); a rock, 10 feet (3m0) high, lies close north-eastward of its south-eastern extremity.

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Port Albert Victor.

The coasts of Shiyal bet (*Lat. 20° 54′ N., Long. 71° 31′ E.*) are composed of rocky cliffs, 34 to 54 feet (10m4 to 16m5) high, with the exception of a part of the north-eastern coast and the shore of a small bay on the north-western side of the islet, which are low and sandy. The islet is but slightly cultivated, and has on its northern and eastern sides the remains of old fortifications; the greater part of the islet is covered with ruins of what must have been extensive buildings and fine temples; there are a few stunted trees near its centre.

On the north-western side of the islet is a small village containing, during the period of the south-west monsoon, a population of between 500 and 600. During the north-east monsoon the islet is almost denuded of its male population, who obtain employment as coolies in the adjacent territories.

The coastal reef extends about 1½ cables southward from the southern side of Shiyal bet and about 1½ cables westward from its western side; shoal water projects about 3¼ cables west-south-westward from the south-western point of the islet; an extensive bank of sand and mud, which dries from one to 3 feet (0m3 to 0m9), extends about 8½ cables east-north-eastward from its eastern side.

Mushroom rock, 8 feet (2m4) high, with a rock, 4 feet (1m2) high, close south-westward of it, lie on the coastal reef off the south-western extremity of Shiyal bet.

The channel northward of Bhensla rock, Sayai bet and Shiyal bet is called East channel, and the channel westward of Shiyal bet is known as West channel.

Two leading beacons, each with a diamond topmark, stand on the mainland, northward of Shiyal bet. The front beacon, 36 feet (11m0) high, is situated about one mile west-north-westward of One Tree hill; the rear beacon, 56 feet (17m1) high, lies about 6 cables north-north-eastward of the front beacon. The beacons, in line, bear 019°.

A beacon stands on a drying reef on each side of the entrance to West channel; the eastern about three-quarters of a cable and the western about 8½ cables west-south-westward of the western extremity of Shiyal bet.

Chachuda temple, 68 feet (20m7) high, situated on the mainland about 1½ miles west-north-westward of the tower on Shiyal bet, is a conspicuous landmark.

Tidal streams.—The ebb stream, which sets in a south-westerly direction from southward of Chánch island, divides northward of Bhensla rock, one branch setting westward through East channel, and thence in a south-westerly direction through West channel, attaining at springs a rate of 2 and at neaps of one knot; the other branch sets towards Savai bet reef, and then in a westerly direction along the coast at a rate of from 2 to 2½ knots at springs and of 1½ knots at neaps.

The flood stream sets across the southern approach to West channel, and there divides. One branch sets in a northerly direction through the channel, and thence in a north-easterly direction towards Chánch island at a rate of from 1½ to 2½ knots at springs and of about one knot at neaps; the other branch sets in an east-north-easterly direction past Savai bet reef, and thence towards Bhensla rock at a rate of 3 knots at springs, and of from 2 to 3 knots at neaps.

Strong eddies form in West channel at high and low water.

Anchorages.—There is good anchorage between the northern end

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Chart 1779, plan of Port Albert Victor.

of Shiyal bet and The Spit in a depth of 30 feet (9m1), mud and sand; this anchorage is sheltered from the south-west monsoon.

For a vessel of about 18 feet (5m5) draught a good berth is with the northern extremity of Shiyal bet, bearing 180°, distant from 2 to 3 cables.

Small craft with local knowledge may obtain anchorage northward of Bhensla rock in depths of from 12 to 18 feet (3m7 to 5m5), mud, where the tidal streams are but little felt.

Directions.—A vessel proceeding to an anchorage northward of Shiyal bet (*Lat. 20° 54′ N., Long. 71° 31′ E.*) is recommended to use West channel only, as it was reported, in 1927, that the depths in East channel have decreased considerably.

West channel.—West channel is narrowed to about 2½ cables in the fairway by the fringing reefs on either side. Vessels entering this channel should bring the leading beacons on the mainland northward of Shiyal bet in line, bearing 019°, and steer in on this bearing, which leads clear of all dangers, until Chachuda temple bears 275°, when course can be altered eastward for the anchorage. *See* view [29].

East channel.—East channel should only be used by light-draught vessels with local knowledge, and only at low water. A vessel proceeding through this channel should steer so as to bring Chachuda temple bearing 261° before Bhensla rock bears 180°, and keep on this bearing until the tomb on Savai bet bears 197°, when course may be altered direct for the anchorage; to keep in a depth of not less than 10 feet (3m0) the above bearing of Chachuda temple must be very carefully preserved.

Charts 1779, plan of Port Albert Victor; 50.

Port Albert Victor.—Port Albert Victor, also known as Pipávár bandar, is situated about 3½ cables north-eastward of the junction between Devrápura and Motapát creeks. It is the port for Dongar, the principal town on this part of the coast, which lies about 7½ miles north-north-eastward of One Tree hill, and is connected to the railway system. Only small vessels with local knowledge can proceed to Port Albert Victor, as there is only a depth of 7 feet (2m1) in the channel leading to it.

Bherái bandar is situated about 1¾ miles up Devrápura creek.

Chart 50.

Coast.—Dangers.—Light.—The coast between the entrances to West channel and Jáfarabad harbour, about 5 miles westward, is cliffy, with precipitous points and fringed by a coastal reef; inland it is undulating and partly cultivated; on most of the hilltops on the coast there are small watch-towers, about 6 feet (1m8) in height.

Várárup temple, 90 feet (27m4) high, situated close to the coast, about 1¾ miles west-south-westward of the western entrance point of West channel, is conspicuous from the southward.

About 1¼ miles south-westward of the western entrance point of West channel the coastal reef dries 5 feet (1m5), and extends about 3½ cables offshore; an islet, 25 feet (7m6) high, stands on the edge of this reef.

A light is exhibited from a wreck lying about 3 cables offshore about 1¼ miles south-westward of Várárup temple.

Chart 1779, plan of Jáfarabad harbour.

Jáfarabad harbour.—Lights.—Beacon.—Dangers.—Jáfarabad

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Jáfarabad harbour.

harbour (*Lat. 20° 52′ N., Long. 71° 23′ E.*) is very shallow, but affords good shelter to small vessels during the south-west monsoon and is much frequented. *See* view A on chart 50.

Jáfarabad creek, about three-quarters of a cable wide at the entrance, trends in a northerly and north-westerly direction from the head of the harbour through flat swampy ground, which is submereged at high water spring tides. The town of Jáfarabad stands on the south-western side of the entrance to the creek.

The entrance to the harbour is about 9½ cables wide but the fairway is restricted to about 3 cables by reefs, which extend from the shores on either side. The bar at the entrance has a depth of only 2 feet (0m6), but there are depths of from 4 to 6 feet (1m2 to 1m8) off the town.

A white house on a hill about half a mile north-eastward of the town is a good mark when approaching from south-westward.

A light is exhibited, at an elevation of 70 feet (21m3), from a white stone beacon, about 15 feet (4m6) in height, near the eastern entrance point of the harbour.

A light is exhibited, at an elevation of 85 feet (25m9), from a conspicuous white circular building with a square base, 50 feet (15m2) in height, situated on the south-western entrance point of the harbour. *See* view [30].

About 1¾ cables south-eastward of the eastern entrance point of Jáfarabad harbour and about 1½ cables offshore there is a 15-foot (4m6) shoal.

A ledge of flat rocks extends about 4½ cables westward from the eastern side of the entrance to the harbour; it is marked by a white masonry beacon, about 15 feet (4m6) in height, situated on the southern point of its western edge (*Lat. 20° 52′ N., Long. 71° 23′ E.*); on this ledge, about three-quarters of a cable south-westward of the eastern entrance point, is a conspicuous rock, known as Square rock, which dries 8 feet (2m4). Some rocks, which dry 9 feet (2m7), lie on the ledge about 4 cables westward of the same point.

A rocky shoal, with a least depth of 3 feet (0m9) over it, lies in the fairway, about 4 cables west-south-westward of the eastern entrance point and about 3¾ cables offshore.

A shoal, with a least depth of 13 feet (4m0), is situated about 1¾ cables east-north-eastward of the south-western entrance point of the harbour; close westward of this shoal is another shoal, with a least depth of 4 feet (1m2); an islet, 22 feet (6m7) high with cliffs, lies close eastward of the south-western entrance point.

The coastal reef, which dries 4 feet (1m2), extends about 1¼ cables eastward from the south-western entrance point, and a flat of soft mud extends about 1½ cables eastward from the western side of the entrance to the harbour.

The head of the harbour is filled by a mud bank, which dries from one to 5 feet (0m3 to 1m5).

Tidal streams.—Outside the harbour the tidal streams set along the coast in an easterly direction with the flood tide, and in a westerly direction with the ebb.

At springs the east-going stream continues to set for one hour after the time of high water by the coast, and the west-going stream continues to set until 4 hours before the time of the following high water;

Charts 50, 2736, 826, 1012, 748b.

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Chart 1779, plan of Jáfarabad harbour.

both streams attain a maximum rate of about 3 knots after running for 3 hours.

At neaps the east-going stream continues to set for half an hour after the time of high water, and the west-going stream until 4½ hours before the time of the following high water; the maximum rate of the flood stream is 1¾ knots and of the ebb stream 1½ knots.

At neaps the stream changes from ebb to flood in a clockwise direction and the flood to ebb in an anti-clockwise direction.

Anchorage.—Good anchorage in fine weather may be obtained in a depth of 45 feet (13m7), with Dark point, the projection about 2 cables north-north-westward of the eastern entrance point, bearing 014°, and the lighthouse on the south-western entrance point bearing 260°.

Jáfarabad.—Jáfarabad (*Lat. 20° 52′ N., Long. 71° 22′ E.*) is a walled town, situated on rising ground, with several round towers, on the highest of which there is a flagstaff, 114 feet (34m7) high. The town can be seen from the eastward and southward, showing over the intervening high ground.

From the middle of October until the middle of May there is regular communication by sea with Bombay and Bhavnagar.

Vegetables and a small quantity of poultry are obtainable.

Storm signals.—Storm signals are displayed from the vicinity of the light-structure on the south-western entrance point of Jáfarabad harbour; the brief system is used. *See* page 20.

Chart 50.

Coast.—Aspect.—Dangers.—Lights.—From Jáfarabad harbour the coast trends west-south-westward for about 23½ miles to the eastern extremity of Diu island.

Mount Nandivela, a conspicuous peak, about 17½ miles north-westward of Jáfarabad is described on page 274; about 12 miles north-eastward of this mountain there is another named Dhua-ke-dongur or Smoke hill, only seen in clear weather; eastward of this the country is hilly as far as Mahuva.

Barman hill, 335 feet (102m1) high, about 6½ miles north-north-westward of Jáfarabad and Lor hill, 480 feet (146m3), about 2¼ miles west-south-westward of Barman hill, are prominent.

Murex bluff, situated about 5¼ miles west-south-westward of the south-western entrance point of Jáfarabad harbour, is 78 feet (22m3) high; Murex reef, which dries from 6 to 9 feet (1m8 to 2m7), extends about one mile eastward from the bluff; shoal water, with depths of less than 3 fathoms (5m5), extends about 2 cables farther eastward and south-eastward.

Rájparu (*Lat. 20° 47′ N., Long. 71° 12′ E.*) is a village on a point about 5½ miles west-south-westward of Murex bluff; there is high ground with steep cliffs close westward of it.

Charts 1779, plan of Simbor anchorage; 50.

About three-quarters of a mile south-westward of the point on which Rájparu village stands and about 4¼ cables offshore is a shoal, with a least depth of 14 feet (4m3).

Bheslá rock, situated about 2¼ miles south-westward of the same point and about one mile offshore, is a rocky islet, 24 feet (7m3) high. Bheslá rock is fringed by a drying reef, except on its south-eastern side; a detached drying reef lies between about 1½ and 3 cables west-south-westward of the western side of Bheslá rock.

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Simbor anchorage.

Pānikota islet (Semah point), situated close eastward of a promontory about 1½ miles westward of Bheslá rock, is Portuguese territory; it has a white flat-topped fort, with a flagstaff, at its northern end; this fort is called Simbor fort. Pānikota islet is connected to the mainland westward by a drying reef, which also extends about 2½ cables east-north-eastward from the islet. *See* view on plan.

A light is periodically exhibited, at an elevation of 25 feet (7m6), from a square pyramid, 5 feet (1m5) in height, situated on Simbor fort.

A light is periodically exhibited, at an elevation of 30 feet (9m1), from a stone column, 22 feet (6m7) in height, situated about 1½ miles north-eastward of Simbor fort.

A light is periodically exhibited, at an elevation of 35 feet (10m7), from a mast, 26 feet (7m9) in height, situated about 1¼ miles north-westward of Simbor fort.

The positions of the latter two lights are approximate.

A temple, 33 feet (10m1) high, is situated on the mainland, about 3½ cables south-westward of Simbor Fort lighthouse.

Chart 50.

From close westward of Pānikota islet a range of cliffs extends for about 2 miles in a westerly direction, and attains an elevation of 44 feet (13m4); the western end of these cliffs appear as a sharp bluff when seen from the eastward.

The town of Nawābandar is situated on a promontory about 4½ miles west-south-westward of Pānikota islet; it has regular communication by sea with Bombay and other coastal ports.

A light is exhibited, at an elevation of 58 feet (17m7), from a white circular building, 24 feet (7m3) in height, situated on the promontory on which Nawābandar town stands.

A light is exhibited, at an elevation of 33 feet (10m1), from each of two white round masonry towers, 22 feet (6m7) in height, situated close together about 1½ miles north-eastward of Nawābandar light-structure.

The promontory on which Nawābandar stands forms the western side of a shallow bay into which Daru creek flows.

About 2½ miles northward of Nawābandar (*Lat. 20° 44′ N., Long., 71° 05′ E.*) there are some prominent trees, and about 1¼ miles westward of these trees is the town of Delvāda, with a large and prominent temple with twin minarets. Delvāda is connected with the general railway system.

Daru creek can be entered by small vessels with local knowledge; its mouth is partially protected by a reef which lies between about 1½ and 3½ cables east-north-eastward of the eastern extremity of the promontory on which Nawābandar stands; this reef dries 3 feet (0m9) in places, but close to its southern edge the depths increase quickly to 10 fathoms (18m3). There is a boat channel between the eastern extremity of the promontory and the western edge of the reef.

The coast for about 2 miles westward of this promontory is high, with deep water close to it.

Caution.—From October to the end of January large fleets of fishing vessels, based on Simbor, Nawābandar, Diu and Bráncavára, at the western extremity of Diu island, will be found from 4 to 8 miles off-shore; these vessels leave barrel buoys and logs to mark their grounds, and it is advisable to give them a wide berth.

Charts 2736, 826, 1012, 748b.

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Chart 50.

Storm signals.—There is a storm signal station at Nawābandar; the brief system is used. *See* page 20.

Chart 1779, plan of Simbor anchorage.

Anchorages. — Directions. — Tidal streams. — There is good anchorage for a small vessel about 3½ cables northward of Bheslá rock (*Lat. 20° 46′ N., Long. 71° 10′ E.*) in a depth of 27 feet (8m2), mud.

A vessel making this anchorage should approach from the south-eastward, and pass at least 2 cables eastward of Bheslá rock. The flagstaff on Simbor fort should be brought in line with Khara △, about one mile west-south-westward, bearing 250°, and a vessel should keep on that bearing to the anchorage. *See* view on plan.

The channel between the reef westward of Bheslá rock and the reef east-north-eastward of Pānikota islet, though sufficiently deep, is not recommended, as there are no leading marks.

The best landing at this anchorage is near a farm situated on a sandy beach, about three-quarters of a mile northward of Simbor fort. Great caution should be exercised if landing at the fort, as the passage between the reefs, upon which there is usually a heavy surf, is narrow.

The tidal streams set in an east-north-easterly and west-south-westerly direction at this anchorage, and in a north-east by north and south-west by south direction in the western entrance.

Chart 50.

Good anchorage can be obtained in a depth of 5 fathoms (9m1), mud, with Nawābandar light bearing 254°, distant about one mile, and with the leading marks, two circular towers, about one mile northward of the lighthouse, in line bearing 315°.

Charts 1779, plan of Diu harbour; 50.

Diu harbour.—Lights.—Dangers.—Diu harbour lies between the eastern end of Ilha Diu, which is situated about 5 miles west-south-westward of Nawābandar light, and the mainland northward.

Ilha Diu is Portuguese territory; it is separated from the mainland by a narrow creek or boat channel, known as Bráncavára creek, which runs through the middle of a large swamp. The sea face of the island is composed chiefly of sandstone cliffs; the hills on its western part are about 100 feet (30m5) high.

Chart 1779, plan of Diu harbour.

Forte do Diu, situated at the eastern extremity of the island, is conspicuous from seaward.

A light is exhibited, at an elevation of 113 feet (34m5), from a white circular tower, 26 feet (7m9) in height, situated in the centre of the citadel of Forte do Diu; this light is known as Cavaleiro light.

A light is periodically exhibited, at an elevation of 15 feet (4m6) from a white hexagonal tower, 15 feet (4m6) in height, situated at the north-eastern extremity of Forte do Diu; this light is known as Couraca light.

Forte do Mar is situated on the northern side of the entrance to Bráncavára creek, about 2 cables north-north-westward of Forte do Diu; it lies at the south-eastern edge of a spit extending about 3 cables offshore, south-eastward of the village of Gogla.

A light is periodically exhibited, at an elevation of 54 feet (16m5), from a white circular tower, 23 feet (7m0) in height, situated on Forte do Mar (*Lat. 20° 43′ N., Long. 71° 00′ E.*).

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Diu harbour.

Shoals, with depths of from 6 to 12 feet (1m8 to 3m7), lie between half a mile and 2 miles east-north-eastward of Couraca lighthouse.

A reef, which dries in places and forms a natural breakwater, extends about half a mile east-north-eastward from the same lighthouse. Small boats can enter Bráncavára creek at any state of the tide through a break in this reef close eastward of the lighthouse, but local knowledge is necessary.

A 4-foot (1m2) shoal lies about 2 cables south-south-eastward of Couraca lighthouse (*Lat. 20° 43′ N., Long. 70° 59′ E.*).

Landmarks.—The following objects are prominent and can be easily recognised by vessels approaching the anchorage:—Gogla north temple, situated about 6½ cables north-north-westward of Forte do Mar; a large square house, about one cable northward of Gogla north temple; a red-roofed guard house, about 8½ cables east-north-eastward of the large square house; and a conspicuous palm tree, about 2 miles northward of Forte do Mar.

Chart 50.

Tidal streams.—The flood stream southward of Diu sets east by north, with a greatest rate at springs of 1½ knots; it often runs for 2 hours after the time of high water by the shore. The ebb stream sets west by south at a rate of 2 knots at springs, and often runs for 2½ hours after the water along the shore has begun to rise.

At the end of January 1836, for two or three days before full moon, the tidal stream, in the offing between Nawābandar and Diu, set westward, at the rate of less than one knot, for 18 hours consecutively; the flood stream during those days was scarcely perceptible.

Chart 1779, plan of Diu harbour.

Anchorages.—Directions.—The harbour of Diu affords no protection from the eastward, and vessels should not anchor there in strong easterly winds, as the holding ground, sand and rock, is indifferent.

There is anchorage about one mile eastward of the village of Gogla in depths of from 18 to 24 feet (5m5 to 7m3); to reach it a vessel should pass between the shoals east-north-eastward of Couraca lighthouse, steering for Gogla north temple, bearing 298°, and anchoring when Couraca lighthouse bears about 240°.

The safest and best anchorage is with Cavaleiro lighthouse bearing 315°, distant from 5 to 6 cables, in depths of from 48 to 54 feet (14m6 to 16m5), mud; this position affords protection from westerly winds, and is the anchorage used by local vessels.

A small vessel with local knowledge can enter Bráncavára creek, and anchor in depths of from 6 to 12 feet (1m8 to 3m7), protected from southerly winds by the reef extending east-north-eastward from Couraca lighthouse. There is a least depth of about 4 feet (1m2) at the eastern entrance of this creek.

Charts 1779, plan of Diu harbour; 50.

Small craft, of a draught not exceeding 6 feet (1m8), and possessing local knowledge, can proceed through Bráncavára creek from Diu to Bráncavára, a town at the western end of Ilha Diu.

Cautions.—Owing to the imperfect nature of the survey in depths of less than 36 feet (11m0), the plan should be used with caution. *See* caution on page 282.

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Diu harbour.

Diu.—The town of Diu (*Lat. 20° 43′ N., Long. 70° 59′ E.*), close westward of Forte do Diu, is enclosed by an ancient wall, which is breached in many places on its western side. There are several prominent buildings. The inhabitants are principally occupied in the fishing industry.

There is regular communication by sea with Bombay and other coastal ports.

Port facilities.—Diu is an indifferent place for supplies; little meat, and but few vegetables, are procurable; salt fish and rice are plentiful. Poultry may be obtained at Gogla.

Good water, for drinking purposes only, is supplied to shipping on application to the Governor; pipes lead to the castle bandar, where small vessels may lie to receive it.

There is a hospital at Diu.

Signal station.—Storm signals.—There is a signal station at Diu.

Storm signals are displayed from a flagstaff in the citadel of Forte do Diu; the brief system is used. *See* page 20.

Charts 1779, plan of Mandwa bay; 50.

Coast.—Dangers.—Nagwa village and fort are situated on a projecting point of Ilha Diu, about $4\frac{3}{4}$ miles westward of the eastern extremity of the island; the old Forte de Nagwa is prominent among the palms.

Close south-eastward of this projecting point is a reef which dries 5 feet (1^m5).

The small bay close north-eastward of this projecting point affords shelter for small vessels from westerly winds.

The coast is cliffy between the projecting point just mentioned and Nagwa point (*Lat. 20° 42′ N., Long. 70° 54′ E.*), about one mile westward; Nagwa point is a dark bluff with cliffs from 30 to 40 feet (9^m1 to 12^m2) high, rising to a summit 65 feet (19^m8) high, marked by a bush; shoal water, over which the sea breaks occasionally, extends about 3 cables west-south-westward from Nagwa point.

Chart 1779, plan of Mandwa bay.

Mandwa bay.—Lights.—Dangers.—Mandwa bay lies between Nagwa point and the eastern extremity of Diu head, about $3\frac{1}{2}$ miles westward.

Between Nagwa point and the entrance to Bráncavára creek, about $1\frac{1}{2}$ miles west-north-westward, the coast is composed of sand dunes which extend inland up to a thick unbroken belt of palm trees. This belt of trees stretches about 2 miles east-north-eastward from Bráncavára, a customs station, situated about $1\frac{3}{4}$ miles north-westward of Nagwa point.

The coast for about 4 cables north-north-westward of Nagwa point is fringed by the coastal reef, which dries.

A light is periodically exhibited, at an elevation of 21 feet (6^m4), from a white circular tower, 21 feet (6^m4) in height, situated on the north-eastern side of the entrance to Bráncavára creek. Two leading lights, also periodically exhibited, lead over the bar.

Close eastward of the above lighthouse there is a conspicuous temple; another temple, situated about 6 cables north-eastward of the lighthouse, is also a prominent mark.

Landing can be effected in calm weather close northward of Nagwa point (*Lat. 20° 42′ N., Long. 70° 54′ E.*) through a break in the coastal reef.

Charts 2736, 826, 1012, 748b.

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Chart 1779, plan of Mandwa bay.

A spit, which dries one foot (0m3), extends about one cable south-south-eastward from the north-eastern entrance point of Bráncavára creek.

Foul ground extends about 3 cables eastward of Kotranes, the low rocky south-western entrance point of the creek; the sea breaks over the foul area. Khasbi reef, about 4¾ cables eastward of Kotranes, dries from 2 to 3 feet (0m6 to 0m9).

There was, in 1936, a depth of 3 feet (0m9) over the bar in the south-western entrance to Bráncavára creek, but it is inadvisable for boats to enter except when it is calm. The best time to enter the creek is between half flood and half ebb; when entering boats should keep close to the reef on the southern side, which is visible, so as to avoid the spit extending southward from the eastern entrance point.

Good fish may be obtained at Bráncavára.

The coast, at the head of Mandwa bay, westward of Kotranes, is composed of low sandhills. Inland there is chiefly marshy land, which is partly submerged at high-water springs.

The entrance to Mandwa creek, which dries, lies about 4½ cables north-north-westward of the eastern extremity of Diu head; the creek has depths of from one to 3 feet (0m3 to 0m9), except just within its entrance where the channel is blocked by sandbanks which dry.

Diu head is a bluff, rocky projection, about 100 feet (30m5) high; it may be identified by the lighthouse, two long dwellings and a small temple, known as Mandwa temple, standing near the summit, from which it slopes in an easterly direction and terminates in a rocky point, on which stands a cairn, 25 feet (7m6) high.

A light is exhibited, at an elevation of 105 feet (32m0), from a white hexagonal building, 32 feet (9m8) in height, situated near the summit of Diu head.

Rocky shoal, the eastern end of which lies about 1¼ miles west-south-westward of Nagwa point, has a least depth of 4½ feet (1m4); it lies in the centre of the entrance to Mandwa bay, and is steep-to. The sea breaks occasionally over this shoal.

Detached shoals, with depths of from 13 to 18 feet (4m0 to 5m5), lie between Rocky shoal and the coast north-westward.

Mandwa Bainsla, situated about 1¾ cables eastward of the eastern extremity of Diu head, is a rock, 5 feet (1m5) high; foul ground, over which the sea breaks heavily, extends about one cable northward and 3 cables eastward from this rock, and the ground is foul between Mandwa Bainsla and the eastern extremity of Diu head. At springs strong tide-rips and overfalls occur eastward of Mandwa Bainsla (*Lat. 20° 41′ N., Long. 70° 50′ E.*).

Anchorages.—Mandwa bay affords shelter from north-westerly winds, and the holding ground is good, but there is frequently a swell setting into it, and with southerly or easterly winds the anchorage should not be used.

Small craft can anchor between Nagwa point and Khasbi reef in depths of 24 feet (7m3); this anchorage is well sheltered from easterly winds and is out of the influence of the tidal streams. Dhows, usually without lights, may be found here at night, as it is a favourite anchorage for sailing craft waiting for the flood stream to proceed up the Gulf of Cambay.

Anchorage may be obtained on either side of Rocky shoal. At the

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Chart 1779, plan of Mandwa bay.

anchorage eastward of this shoal vessels usually lie across wind and tide when the ebb stream sets out of Bráncavára creek; the charted depths at this anchorage are from 33 to 42 feet (10m1 to 12m8), sand and mud.

Vessels are not recommended to anchor midway between Mandwa Bainsla and the western end of Rocky shoal, on account of the strong tidal streams and the exposed position.

There is anchorage for a moderate-sized vessel about one mile east-north-eastward of the eastern extremity of Diu head and about 6 cables offshore in a depth of 27 feet (8m2), sand and mud.

Directions.—A vessel intending to anchor eastward of Rocky shoal should approach with the light-tower at the entrance to Bráncavára creek (*Lat. 20° 43′ N., Long. 70° 52′ E.*) bearing 320°, and anchor when the southern extremity of Nagwa point bears 077°, distant 8½ cables, in a depth of 36 feet (11m0), sand and mud.

A vessel approaching from the eastward and intending to anchor north-westward of Rocky shoal should steer with Mandwa Bainsla, or the eastern extremity of Diu Head, bearing more than 283°, and open well northward of Diu Head lighthouse; this leads southward of the southern extremity of Rocky shoal. A vessel should alter course northward for the anchorage one mile east-north-eastward of the eastern extremity of Diu head when the easternmost of two distant sharp peaks bears 005°, and steer for it on that bearing, taking care to avoid the 16-foot (4m9) shoal lying about one mile south-westward of Kotranes. She can anchor when the cliffs on the southern side of the entrance to Mandwa creek bear 270°, with the southern entrance point of the creek distant about 1¼ miles.

When approaching this latter anchorage it should be remembered that the flood stream sets strongly towards Rocky shoal and the ebb stream towards Mandwa Bainsla.

Caution.—*See* page 282.

Chart 2736.

Coast.—Dangers.—From Diu head the coast trends west-north-westward for about 10 miles to Mul Dwárka; it consists of rocky points, with sandy bays between, and some cliffs of from 30 to 40 feet (9m1 to 12m1) in elevation.

This part of the coast is fronted by a rocky shoal, lying about 1½ miles offshore, and having a least depth of 2 fathoms (3m7) over it. A vessel should not approach it to within a depth of 13 fathoms (23m8).

The lighthouse on Diu head, bearing less than 079°, leads southward, and Mul Dwárka, bearing more than 333°, leads westward of this shoal.

The village of Chára is situated near the coast, about 7 miles west-north-westward of Diu Head lighthouse; it is more densely wooded here, and the trees are larger than elsewhere on the coast. About three-quarters of a mile westward of Chára there is a white tomb close to the coast.

The town of Korinar, about 3 miles north-eastward of Mul Dwárka, is just visible amongst the trees.

Singaora river flows into the sea about half a mile eastward of Mul Dwárka, and Surmat river about 1½ miles westward of this point; the former river has very little water in it, except during the rains.

Mul Dwárka is a small bluff point with an old temple on its summit, which has an elevation of 78 feet (23m8); it may be identified by the

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Chart 2736.

white sand on the top of the cliffs, and the dark building of the temple.

There is a good landing place for boats on the south-eastern side of Mul Dwárka.

Between Mul Dwárka and Sutrápára, a town close to the coast, about 11 miles west-north-westward, the coast is low and sandy, with patches of cliffs at intervals.

Chart 1470.

Just southward of Sutrápára there is a cove, which affords anchorage to small craft, being somewhat protected by a spit; the bandar, near the centre of the cove, is a good landing place. On the south-eastern side of the cove there are high sandhills, and on the north-western side there are cliffs about 50 feet (15^{m}2) high.

The coastal reef extends a short distance offshore in the vicinity of the south-eastern entrance point of the cove, and has two large rocks on it.

Chart 2736.

Tidal streams.—Between Diu head and Sutrápára the ebb stream sets in a west-north-westerly direction, and the flood stream in an east-south-easterly direction, at a rate of from about one to 1½ knots, but they are subject to irregularities. In December and January, with the current setting up the coast, the west-going stream is increased, whereas the east-going stream is weakened and may at times be imperceptible.

Charts 1321, plan of Veraval roads; 1470.

Veraval.—Lights.—Veraval (*Lat. 20° 54′ N., Long. 70° 22′ E.*), a large town, situated on the coast about 7½ miles west-north-westward of Sutrápára, shows up well from seaward, as many of the houses rise abruptly from the surrounding country; the custom house, a large white building facing the sea, is the most prominent. In 1951, the town had a population of 40,378. *See* view on plan.

Chart 1321, plan of Veraval roads.

About 1¾ miles east-south-eastward of Veraval is Somnáth pátan, a town of about the same size as Veraval; it is surrounded by a wall of dark-coloured stone, within which are the ruins of the once famous temple of Somnáth.

A light, known as Veraval light, is exhibited, at an elevation of 56 feet (17^{m}1), from a white octagonal tower with black bands, 40 feet (12^{m}2) in height, situated near the root of the breakwater. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 30 feet (9^{m}1), from a red and white masonry structure, 16 feet (4^{m}9) in height, situated close south-westward of Bhirria (Bhiria) temple, about 8 cables eastward of Veraval light. This light is known as Bhirria beacon.

Signal station.—There is a signal station at Veraval, with which signals may be exchanged by means of the International Code of Signals or the Morse code.

Harbour.—Depths.—Dangers.—Buoyage.—A breakwater extends south-eastward from Veraval lighthouse for a distance of 1,650 feet (502^{m}9).

There are two basins in the inner harbour, situated close eastward of the lighthouse with four quay walls alongside which vessels can berth; the depths alongside two of these quays are 13 feet (4^{m}0), and alongside

Charts 826, 1012, 748b.

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Chart 1321, plan of Veraval roads.

the two others 7 feet (2m1). The channels leading to the quays are maintained by dredging.

A shoal, with a least depth of 5½ fathoms (10m1), is situated about 1¼ miles south-eastward of Veraval lighthouse and about 9 cables offshore.

A red can light-buoy with a trestle topmark, exhibiting a *red group flashing* light having *two flashes every fifteen seconds*, is moored about 6½ cables south-westward of Bhirria light-beacon.

A detached rocky shoal, with a least depth of 2½ fathoms (4m6) over it, lies about 4½ cables south-eastward of Veraval lighthouse and about 4 cables offshore; close west-north-westward of this shoal is a detached 3-fathom (5m5) shoal.

A shallow spit, with depths of 6 feet (1m8) and less over it, extends nearly 3 cables south-eastward from Veraval lighthouse; close northward of this spit, about 2 cables east-south-eastward of Veraval lighthouse, is a detached shoal, with a depth of 3 feet (0m9), which is marked at its southern end by a red conical buoy.

From a point on the coast, about 3 cables north-eastward of Veraval lighthouse (*Lat. 20° 54′ N., Long. 70° 22′ E.*), the coastal reef, with depths of less than 6 feet (1m8) over it, extends in a southerly direction to a distance of about 1¾ cables offshore; it is marked at its southern edge by a white conical buoy. South-eastward of this buoy the coastal reef, with similar depths over it, extends into the harbour, for about 2 cables from the northern shore, as far eastward as Bhirria beacon.

The entrance to the inner anchorage lies between the buoys described above, which are withdrawn annually during June, July and August. There are depths of from 10 to 13 feet (3m0 to 4m0) in the inner anchorage and the general depths in the harbour less than 3 fathoms (5m5).

Anchorages.—Tidal streams.—Good anchorage may be obtained with Veraval lighthouse bearing 338°, Deni Barra, a cliffy point, 30 feet (9m1) high, with a temple, 25 feet (7m6) in height, standing on it, about 1¾ miles north-westward of Veraval lighthouse, and which is conspicuous from the anchorage (*see* view on plan), bearing 315°, and Bhirria temple in line with Bhirria beacon, bearing 040°, in charted depths of from 7 to 10 fathoms (12m8 to 18m3), sand.

Anchorage may be obtained in fine weather with Deni Barra temple bearing 313°, Veraval lighthouse 341° and Bhirria temple 058°, in charted depths of from 5½ to 6½ fathoms (10m1 to 11m9).

There are no perceptible tidal streams in the roadstead, but there is sometimes a surface drift of about half a knot, depending on the wind.

Port facilities.—Vessels load and discharge by lighters working to the quays in the inner harbour, which are connected with the railway system.

Tugs are available.

Good water can be supplied to vessels by a water boat, with a capacity of 19 tons. Fresh provisions can be obtained.

There are eight cranes with capacities of from 1½ to 20 tons.

Communications.—Veraval is connected with the general railway system.

There is regular communication by sea with Bombay and other coastal ports, except during the months of June, July and August, when the port is closed.

Charts 1470, 2736, 826, 1012, 748b.

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Chart 1321, plan of Veraval roads.

There is a regular air service to Bombay from Keshod, about 50 miles from Veraval.

Storm signals.—Storm signals are displayed from a mast above the custom house at Veraval; the general system is used. *See* page 20.

Trade.—Shipping.—The chief exports are onions, cotton, groundnuts, limestone, ghee, fruit and vegetables. The main imports are timber, cottonseed, grain, salt, petroleum products, dates and tea.

In 1958-59, 125 powered vessels and 1,531 sailing vessels with total net registered tonnages of 193,688 and 104,564, respectively, used the port.

Chart 1470.

Coast.—Lights.—From Veraval the coast trends north-westward for about 62 miles to Porbandar; the coast between Veraval and Chorwád bandar, about 10 miles north-westward, is generally sandy, with low cliffs here and there, but the bottom being rocky renders landing difficult.

Megal river flows into the sea, during the south-west monsoon, about half a mile south-eastward of Chorwád bandar, but, like most of the rivers on this coast, its mouth is generally damned up with sand during the fine season.

The town of Chorwád is situated near the coast, about 2 miles north-north-westward of the north-western entrance point of Megal river.

Mángrol bandar (*Lat. 21° 07′ N., Long. 70° 06′ E.*), situated about 10½ miles north-westward of the entrance to Megal river, is a boat anchorage, formed by a ledge of flat rock, against the inner side of which three or four small craft can lie; it is open to all winds except those from the north-westward and north-eastward. There is a pier about 400 feet (121^{m}9) long, equipped with a steam crane. Fresh provisions and vegetables are obtainable.

A light is exhibited, at an elevation of 85 feet (25^{m}9), from a square house, 45 feet (13^{m}7) in height, situated 2 cables from the landing place at Mángrol.

A light is exhibited, at an elevation of 34 feet (10^{m}4), from a mast, 15 feet (4^{m}6) in height situated about 1¼ miles south-eastward of the lighthouse at Mángrol.

There is regular communication by sea with other coastal ports, except during the months of June, July, and August, when the port is closed.

The town of Mángrol lies about one mile inland; it has a high tower, which is prominent from a distance of about 10 or 12 miles. The mosque here is the finest in Kāthiāwār. Near this place there are cotton and betel-nut plantations, also many trees.

Mángrol is connected with the general railway system, and, in 1951, had a population of 20,085.

The tidal streams are not perceptible in the vicinity of Mángrol bandar. Sil bandar, about 5½ miles north-westward of Mángrol bandar, lies at the mouth of a shallow creek, but it is only available for native craft, and that only during the rains; on the south-eastern entrance point of the creek there is a square tower on a high sandy mound.

The town of Sil is situated about one mile within the creek; the village of Miransha lies about 1½ miles south-south-eastward of Sil and about three-quarters of a mile inland.

Mādhavpur, about 6½ miles north-westward of Sil bandar, is a small

Charts 2736, 826, 1012, 748b.

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Chart 1470.

walled town situated on the coast; the beach here is steep and sandy, but landing is difficult on account of the surf. There are high sandhills on the coast between Sil bandar and Mādhavpur.

Charts 1321, plan of Navibandar; 1470.

Navibandar (*Lat. 21° 27′ N., Long. 69° 47′ E.*), situated about 15 miles north-westward of Mādhavpur, is a walled town situated close to the coast; Bhadar river flows into the sea about three-quarters of a mile north-westward of Navibandar.

Bhadar river is difficult of access, and its entrance is shallow and rocky; native craft, with a draught of 6 feet (1^{m}8), enter during the fine season.

A light is periodically exhibited, at an elevation of 58 feet (17^{m}7), from the sea-face wall of the centre bastion at Navibandar.

Between Navibandar and Porbandar the coast consists of sandhills, with clumps of trees near the villages, inland of which there is an extensive swamp where water-fowl abound.

At Tunkra village, about 5½ miles north-westward of Navibandar, there is a prominent temple.

Currents.—The currents off the coast are of monsoonal origin and flow predominantly parallel to the coast, north-westward in December and January, and south-eastward for the remainder of the year; rates of up to about 1½ knots may be experienced during the south-west monsoon and up to about 1 knot at other times.

Chart 1470.

Storm signals.—There is a storm signal station at Mángrol; the brief system is used. *See* page 20.

Anchorages.—Chorwád bandar is a small-craft anchorage. A palace on the beach is prominent.

Charts 1321, plan of Navibandar; 1470.

Good anchorage may be obtained off the entrance to Bhadar river, with Navibandar light-structure bearing 099°, in a depth of about 5 fathoms (9^{m}1).

Chart 1321, plan of Porbandar; 1470.

Porbandar.—Dangers.—Lights.—Landmarks.—The town of Porbandar (*Lat. 21° 38′ N., Long. 69° 36′ E.*) is situated at the head of an indentation on the eastern side of Kádar Pir, a point about 10 miles north-westward of Tunkra; this indentation is shallow as the coastal bank in this vicinity, with depths of less than 3 fathoms (5^{m}5), extends about three-quarters of a mile offshore. For radar range *see* Appendix III on page 346.

Several patches, with depths of from 2½ to 3 fathoms (4^{m}6 to 5^{m}5), lie just outside this coastal bank.

The Bārdā range (page 274) is visible in clear weather from seaward from a distance of about 25 or 30 miles.

Chart 1321, plan of Porbandar.

A light is exhibited, at an elevation of 101 feet (30^{m}8), from a white stone circular tower with black horizontal bands, 83 feet (25^{m}3) in height, situated on the sea-face of the town of Porbandar.

Two lights, vertically disposed, are exhibited, at elevations of 70 and 73 feet (21^{m}3 and 22^{m}3), from a flagstaff, 68 feet (20^{m}7) in height, situated, in the grounds of New Hazur palace, about one mile south-eastward of Porbandar light-tower (*Lat. 21° 38′ N., Long. 69° 36′ E.*).

The Rajah's old palace lies about 3 cables south-eastward of New Hazur palace.

Charts 39, 2736, 826, 1012, 748b.

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Chart 1321, plan of Porbandar.

The light-tower and Handley's tomb, about 2½ cables east-south-eastward, are prominent and easily identified. *See* view on plan.

A creek, the entrance to which is situated on the eastern side of Kádar Pir, is narrow and fronted by reefs, which dry from one to 6 feet (0m3 to 1m8); two rocks, with depths of less than 6 feet (1m8) over them, lie at the south-eastern edge of the drying reefs, between about 3 and 3½ cables east-south-eastward of the southern extremity of Kádar Pir (*Lat. 21° 38′ N., Long. 69° 35′ E.*).

The port is closed to navigation from the end of May until 20th September, annually.

Tidal streams.—In the offing the tidal streams are not perceptible.

In the creek the ebb stream runs very strongly, and continues for some time after the time of low water; great care is necessary, when leaving the creek on the ebb, to avoid being set on the reef abreast the entrance. When this reef is covered small vessels of 3 feet (0m9) draught, and at high-water springs those of 6 feet (1m8) draught, can enter the creek.

Anchorages.—Directions.—Beacon.—The outer anchorage is situated about one mile south-south-westward of Porbandar light-tower; vessels can anchor with the light-tower bearing 026° and the Rajah's old palace bearing 085°, in depths of 4½ to 5 fathoms (8m2 to 9m1), sand and mud, or farther out as required.

A pool, in which there are depths of from 3¼ to 4 fathoms (5m9 to 7m3), is situated between about 2 and 7 cables south-south-eastward of the light-tower. Small vessels can anchor in this pool from 1½ to 2 cables offshore; it is entered over a bar which has a least depth of 2¼ fathoms (4m1).

A white stone beacon, standing on the coast about half a mile south-eastward of the light-tower, in line with the northern shoulder of the Bārdā range, bearing 021°, leads towards this latter anchorage in a least depth of 13 feet (4m0); when the light-tower bears 336° a vessel should steer for it on this bearing, and anchor as convenient. *See* view on plan.

Town.—Porbandar is the largest town on this coast. In 1951, it had a population of 58,824.

A large trade is conducted with other coastal ports, the Persian gulf and the east coast of Africa.

Port facilities.—Loading and discharging of cargo is carried out by means of lighters. The lighters load and discharge within Porbandar creek at a wharf which is connected with the railway system, and is equipped with eight cranes with capacities of from one to 7 tons. In 1960, a new wharf was under construction in the inner harbour.

Bread, vegetables and fish are obtainable. Fresh water is available in small quantities.

There is a well equipped hospital.

Storm signals.—There is a storm signal station at Porbandar; the general system is used. *See* page 20.

Communications.—There is regular communication by air with Bombay.

Trade.—Shipping.—The principal exports are salt, cement, ghee and oilcake. The main imports are cottonseed, grain, timber, dates and petroleum products.

Charts 1470, 39, 2736, 826, 1012, 748b.

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Chart 1321, plan of Porbandar.

In 1958-59, 129 powered vessels with a total net registered tonnage of 292,968 used the port.

Chart 1470.

Coast.—Dangers.—Light.—From Kádar Pir (*Lat. 21° 38′ N., Long. 69° 35′ E.*) the coast trends north-westward for about 16 miles to the entrance of Meda creek; it is low, but rises gradually to the north-westward.

There are depths of 10 fathoms (18^{m}3) about 2 miles offshore, and within these depths the bottom is rocky.

Meda creek, which is the estuary of Vartu river, dries. For radar range *see* Appendix III on page 346.

Miáni, a small village with a fort, is situated on the eastern side of the creek, about one mile within its entrance.

The bandar of Miáni lies on the western side of the creek, abreast Miáni; near this, on a hill, about 182 feet (55^{m}5) high, is a pagoda or temple.

The town of Rāwal is situated about 10 miles up Vartu river.

From the entrance to Meda creek the coast trends north-westward for about 22 miles to Madhi; it consists of a high sandy ridge, broken here and there by gaps, the only prominent objects being two small conical hills 3 miles south-eastward of Madhi.

Lámba, about 5 miles north-westward of Miáni, is a small town lying about 1½ miles inland.

Madhi is a hamlet with a small dark-looking temple and an old tower, standing on elevated rocky land near the coast; it is connected with the railway system.

About 4¾ miles north-westward of Madhi is the mouth of a freshwater stream which flows into the sea during the rainy season. There are many such streams along the Kāthiāwār coast, which have at their mouths gaps in the coral reef which fringes the coast, furnishing good landing places where small boats can lie aground on the mud.

Wáchu is a village about 2¾ miles northward of the mouth of the freshwater stream described above and about 2 miles inland.

Charts 1470, 43.

The coast between Madhi and Dwárka, a town about 12 miles north-westward, is composed of sandhills; between Dwárka and Kachigadh about 5¼ miles northward, it is cliffy, and thence to Vomani point, the northern extremity of Okhāmandal peninsula, there are sandhills.

At high-water spring tides, and in the south-west monsoon, Okhāmandal peninsula is very nearly isolated by the submergence of the Rann, a salt marsh that extends from Madhi for 12 miles in a north-easterly direction, into Pindāra bay on the southern side of the Gulf of Kutch.

Okhāmandal peninsula is very low, the substratum being sandstone. The soil is only cultivated around the villages; the agriculturists depend on the south-west monsoon for a supply of water, wells being scarce. The prickly pear grows profusely all over the peninsula.

Dwárka point, the western extremity of the promontory on which Dwárka stands, has on it a lighthouse. Three tall iron chimneys in the vicinity of the lighthouse are very prominent; the highest of these chimneys is 225 feet (68^{m}6) high. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 76 feet (23^{m}2), from a white

Charts 39, 2736, 826, 1012, 748b.

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Charts 1470, 43.

square stone tower, with a broad black band at the top, 58 feet (17m7) in height, situated on the cliff of Dwárka point.

Dwárka temple, also called Jagat Mandir, is a shrine of very great sanctity, and is resorted to by large numbers of pilgrims from all parts of India; it stands within Dwárka fort, on an eminence close to the sea. The structure, 168 feet (51m2) high, is of stone, carved with figures from the base to the summit, and, in clear weather, forms a prominent landmark, which is visible from a distance of 17 to 18 miles in clear weather. A column stands a short distance westward of the temple, close to the edge of the cliffs.

The landing place is on the steep sandy beach southward of the lighthouse, between the cliffs and the mouth of Gomti creek, which is situated about half a mile south-eastward of the lighthouse, near an old dark-looking temple washed by the sea at high tide. With any southerly swell there is too much surf to land here, and boats should then proceed into Rupān bandar, about one mile northward of Dwárka Point lighthouse (*Lat. 22° 14′ N., Long. 68° 58′ E.*).

The cliffs between Dwárka and Rupān bandar are about 40 feet (12m2) high and covered with cactus bushes.

Rupān bandar, the port of Dwárka, is marked by a square flat-topped house on a sandy neck of land, on the northern side of a creek, also by two or three small buildings. Rupān bandar is shallow and much obstructed by rocks at the entrance. Small native vessels visit this port and lie aground at low water on a fine sandy beach where the water is smooth, as the sea breaks on the fringing reef half a mile westward. There is a pier here, about 100 feet (30m5) long, alongside which small craft can lie.

Currents.—*See* page 211.

Anchorage.—A large vessel can obtain anchorage with Dwárka temple, bearing 069°, distant 1½ miles, in depths of from 11 to 12 fathoms (20m1 to 21m9), sand, but the bottom is rocky in the approach to the Gulf of Kutch, and several vessels have lost anchors in this neighbourhood.

Dwárka town is connected with the general railway system.

Storm signals.—There is a storm signal station at Dwárka; the brief system is used. Storm warnings are received at Rupān bandar but no signals are hoisted. *See* pages 20 and 23.

Climatic table.—*See* page 54.

Chart 43.

Coast.—Dangers.—Beacons.—Lights.—Buoy.—The coast between Rupān bandar and Kachigadh is fringed by a coral reef and rocks, which extend about half a mile offshore.

Warwála, about 2¾ miles northward of Dwárka Point lighthouse and about one mile inland, is a large walled town; a square tower in the town is prominent and visible from several miles to seaward.

Kachigadh is situated at the head of a shallow bay, open to the north-westward, where there is good landing on the sandy beach northward of the fort; the beach is frequented by turtle.

Mojap beacon, a black masonry structure, 36 feet (11m0) in height, is situated on the coast, about 1½ miles northward of Kachigadh.

Between Kachigadh (*Lat. 22° 20′ N., Long. 68° 57′ E.*) and Árámda reefs, about 7½ miles north-north-eastward, foul ground extends about 1½ miles offshore.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

About 2 miles northward of Kachigadh there is a sandhill with bushes on it, about 100 feet (30m5) high.

Charts 47, 43.

About 4½ miles north-eastward of Mojap beacon and about 1¼ miles inland there is a conspicuous chimney, 320 feet (97m5) in height.

Mithapur light is exhibited, at an elevation of 174 feet (53m0), from the top of a building close north-eastward of the above-mentioned chimney.

Arámda beacon, a black masonry structure, surmounted by a staff and globe, 50 feet (15m2) in height, is situated on the coast, about 5½ miles north-north-eastward of Mojap beacon.

Chart 47.

The walled town of Arámda is situated about 1¾ miles eastward of Arámda beacon.

Arámda reefs extend about 1½ miles off the coast north-westward of Arámda town; they have a least depth of 3 feet (0m9) over them.

Vomani point, the northern extremity of Okhāmandal peninsula and the southern entrance point of the Gulf of Kutch, lies about 3½ miles north-eastward of Arámda town. A black and white beacon and a black beacon, both diamond-shaped, stand on the coast about 1¼ cables south-south-eastward and 4 cables south-south-westward, respectively, of the northern extremity of Vomani point.

Patches, with depths of 2¾ and 3 fathoms (5m0 and 5m5), lie about 6 cables south-westward and 4 cables west-north-westward of Vomani point (*Lat. 22° 29′ N., Long. 69° 04′ E.*).

The dangers northward and eastward of Vomani point are described on page 299.

Marian shoal, a detached shoal, about 2½ miles westward of Vomani point, has a least depth of 2 fathoms (3m7). Bobby shoal, lying about 6¼ cables northward of Marian shoal, has a least depth of 1½ fathoms (2m7); it is marked on its northern side by conical buoy "B", painted black and white in chequers and surmounted by a cone.

Marian and Bobby shoals lie on a bank, which, with depths of less than 6 fathoms (11m0) and a least depth of 3¼ fathoms (5m9), extends about 9 cables north-eastward from Bobby shoal, 3 cables north-eastward and south-westward from Marian shoal and south-eastward from Marian shoal to the coastal reef.

Off-lying dangers.—Buoy.—Gurur shoal, lying about 5½ miles north-westward of Vomani point is composed of sand and rock, and has a least depth of 2 fathoms (3m7); it is marked on its south-eastern side by red can buoy "G", surmounted by a trestle. Three detached 3-fathom (5m5) shoals lie between about 2½ cables and one mile south-westward of the south-western end of Gurur shoal. Shoal water, with depths of 6 fathoms (11m0) and less, extends about 2¼ miles south-westward and east-north-eastward from Gurur shoal as defined by the 3-fathom (5m5) line.

Lushington shoal or Unniamor, situated about 17½ miles west-north-westward of Vomani point, is described on page 297.

Charts 47, 43.

Directions.—Kachigadh fort in line with Dwárka temple, bearing 171°, leads westward of Gurur shoal. Samiāni lighthouse (page 298), which is situated about 1¼ miles north-eastward of Vomani point, bearing between 092° and 103°, leads southward of the shoal in a depth

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Charts 47, 43.

of not less than 7 fathoms (12^{m}8); it should be noted however that Bobby shoal lies about 3½ miles westward of Samiāni lighthouse and between the above bearings.

Between Gurur shoal and the mainland southward and south-eastward the depths are irregular; heavy tide-rips are experienced, particularly on the ebb tide, on either side of the intervening deep-water channel; the sea sometimes breaks in this channel even in calm weather.

Tidal streams.—Abreast Rupān bandar (*Lat. 22° 14′ N., Long. 68° 57′ E.*) the tidal streams set in a northerly direction with the flood tide at a rate of sometimes more than 2 knots, and in a south-south-easterly direction with the ebb at about the same rate. Farther northward the tidal streams are stronger.

Chart 47.

At the western edge of Gurur shoal the tidal streams set in an easterly direction with the flood tide and in a westerly direction with the ebb, attaining a rate of 1½ knots at neaps.

Charts 39, 2736, 826, 1012, 748b.

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CHAPTER VIII

THE GULF OF KUTCH AND THE COAST FROM MĀNDVI TO CAPE MONZE INCLUDING THE PORT OF KĀRACHI

Chart 43.

GULF OF KUTCH.—General remarks.—The Gulf of Kutch lies between the north coast of Kāthiāwār peninsula and the south coast of Kutch district; it possesses some sheltered anchorages and harbours.

The shores of the gulf are uniformly low; the southern is fronted with islands and islets covered with brushwood and surrounded by coral reefs, while the northern, which consists of sand and mud, is fronted by numerous shoals.

The depths are very irregular for a distance of about 30 miles within the entrance, and from thence eastward the depths decrease gradually towards the shores of the gulf, and the bottom changes from rock and sand to mud; there are dangerous rocky shoals lying in the fairway of the gulf, about 8 miles within its entrance.

Across the mouth of the gulf the strong tidal streams setting over the uneven bottom cause a confused breaking sea.

Pilots.—Pilots for the gulf are obtainable at Māndvi (*Lat. 22° 50′ N., Long. 69° 21′ E.*), on the northern side of the gulf, about 7 miles within its entrance.

Chart 47.

Dangers in approach.—Lushington shoal or Unniamor, situated in the fairway of the western approach to the Gulf of Kutch, about 18½ miles west-north-westward of Vomani point, the northern extremity of Okhāmandal peninsula and the southern entrance point of the gulf, has a least depth of 2¾ fathoms (5^{m}0); the bottom consists of sand and rock, and the shoal can be usually identified by the discolouration of the water over it.

An obstruction, dangerous to navigation, was reported in 1957 about 8 cables north-north-westward of the north-eastern extremity of Lushington shoal, as defined by the 3-fathom (5^{m}5) line.

Gurur shoal, lying about 5½ miles north-westward of Vomani point, together with its clearing marks, and Bobby shoal and Marian shoal, about 2½ miles westward of Vomani point, are described on page 295.

Caution.—In 1960, about 8 to 10 feet (2^{m}4 to 3^{m}0) less water than charted was reported to exist in the approach to the Gulf of Kutch between Lushington shoal and The Swatch (page 332), about 90 miles north-westward.

Tidal streams.—In the vicinity of Lushington shoal the tidal streams set in an east-south-easterly direction with the flood tide, attaining a rate of 1¾ knots at neaps.

For a description of the tidal streams in the vicinity of Gurur shoal, *see* page 296.

Charts 39, 2736, 826, 1012, 748b.

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Chart 1321, plan of Okha.

SOUTHERN SIDE OF GULF.—Okha and approaches.—The harbour of Okha lies between the northern end of Okhāmandal peninsula and Beyt island; it is open throughout the year, and is well protected by Samiāni island (*Lat. 22° 29′ N., Long. 69° 05′ E.*) and the banks northward of the approach.

Aspect.—Lights.—Okha point, about one mile east-south-eastward of Vomani point, is low and sandy; a flagstaff, about 100 feet (30^{m}5) high, stands on the point.

A light is exhibited, at an elevation of 94 feet (28^{m}7), from a white square masonry tower with red bands, 80 feet (24^{m}4) in height, situated near the coast about 6½ cables west-north-westward of Okha point.

The several buildings in the vicinity of Okha point cover a large area and form the town of Okha. Adatra village lies about one mile southward of Okha point.

Samiāni island lies with its south-western extremity, 115 feet (35^{m}0) high, about 6½ cables northward of Okha point. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 71 feet (21^{m}6), from a white circular stone tower, 65 feet (19^{m}8) in height, situated near the centre of Samiāni island. *See* sketch on chart 47.

A tomb, 35 feet (10^{m}7) high, stands on a small mound close northward of the lighthouse.

A light is exhibited, at an elevation of 32 feet (9^{m}8), from a white concrete tower with black bands, 43 feet (13^{m}1) in height, off the north-eastern edge of the drying reef extending from the north-eastern end of Samiāni island.

Charts 1321, plan of Okha; 47.

Beyt island lies with Padmatirth point, its north-western extremity, about 9 cables south-eastward of Okha point.

The north-eastern part of the island is composed chiefly of sandhills; there are three clumps of coconut and a few other trees on it, but elsewhere it is almost entirely covered with open jungle of prickly pear bushes and thorny scrub. Hanumān temple, situated about 7 cables westward of Hanumān point, the eastern extremity of the island, is the only building on this part of the coast; it is hidden by trees, which, however, are prominent and identify the position of the temple sufficiently well to enable a bearing of it to be taken.

The south-western part of the island, which forms the eastern side of the harbour, is of rocky tableland formation. Padmatirth point is a small bluff tableland about 30 feet (9^{m}1) high, which becomes an islet at the highest spring tides; near the bluff is a small white-domed tomb.

The town of Beyt, about half a mile southward of Padmatirth point, is one of the few great resorts of pilgrims in the north-west of India; it has numerous temples and shrines in honour of Krishna of which Dwarkadhish (Dwarka Dhis) temple, a large square building, 90 feet (27^{m}4) high, situated near the centre of the town, is very prominent. Close to the small landing jetty off the town are some rather imposing-looking buildings for the accommodation of pilgrims; the rest of the town is mainly composed of stone and mud houses.

Shankholia point, 60 feet (18^{m}3) high, the southern point, is the highest part of the island.

Pilots.—Pilotage is compulsory. Pilots board vessels outside the harbour, about 1½ miles north-north-westward of Samiāni lighthouse

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Charts 1321, plan of Okha; 47.

(*Lat. 22° 29′ N., Long. 69° 05′ E.*), in which position a vessel should await the arrival of the pilot. A vessel should be in this position 1½ hours before high water, or at low water, during the north-east monsoon, and half an hour before high water, or 1½ hours before low water, during the south-west monsoon.

Pilotage is carried on during daylight hours only.

Dangers in approaches.—Buoys.—Marian and Bobby shoals, 2½ miles westward of Vomani point, are described on page 295.

Foul ground and shoal water, with depths of less than 3 fathoms (5^{m}5), extend up to about 4½ cables offshore between Vomani and Okha points; the northern edge of the shoal water is marked by No. 3 black conical buoy.

A detached 3-fathom (5^{m}5) shoal lies about 1½ miles north-north-westward of Vomani point; it is marked on its northern side by No. 1 black conical buoy, surmounted by a cone.

Samiāni shoal is a large shoal the eastern extremity of which is situated about 3 cables northward of the north-eastern end of Samiāni island; from its eastern extremity it extends about 1¼ miles west-north-westward and south-westward, its south-western edge being about 3 cables northward of Vomani point.

No. 2 black conical buoy is moored off the eastern extremity of Samiāni shoal.

Samiāni island is fringed by a reef which dries in places and extends about 1¾ cables north-eastward from the island; the north-eastern extremity of the reef is marked by the lighthouse described on page 298.

Foul ground and shoal water, with depths of less than 3 fathoms (5^{m}5), extend about 2¾ cables south-eastward from the south-eastern side and about three-quarters of a cable southward and south-westward from the southern extremity of the island.

A red conical buoy is moored on the south-eastern edge of the above shoal water, and another similar buoy lies off its north-eastern extremity, about 2¾ cables south-eastward and 2½ cables east-south-eastward, respectively, of Samiāni Island lighthouse.

Foul ground and shoal water, with depths of less than 3 fathoms (5^{m}5), extend about 1¾ miles northward and north-eastward from the northern side of Beyt island; the north-western part of this foul area dries one foot (0^{m}3) in places, and is marked at its northern edge by No. 2 red can buoy, surmounted by a drum; the western side is marked by a black can buoy and a red can buoy moored about 1½ miles and one mile, respectively, northward of Padmatirth point (*Lat. 22° 28′ N., Long. 69° 05′ E.*). The north-eastern part of the foul ground is known as Hanumandanda reef.

A shoal, with a least depth of 1¼ fathoms (2^{m}3), and two 3-fathom (5^{m}5) patches lie about three-quarters of a mile and 1¼ miles, respectively, east-north-eastward of Samiāni Island lighthouse.

A large shoal, the western extremity of which is situated about 1½ miles northward of Samiāni Island lighthouse, has a least depth of 1½ fathoms (2^{m}7); No. 1 red can buoy, surmounted by a drum, is moored about one quarter of a mile west-south-westward of the western extremity.

Chinri reef, the south-western end of which lies about 2¼ miles north-eastward of Samiāni Island lighthouse, is situated at the south-western corner of an extensive shoal, which extends about half a mile north-

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Charts 1321, plan of Okha; 47.

westward, from about a quarter to half a mile northward, and from about 1¼ to 1¾ miles eastward from the reef; Chinri reef dries, and the shoal on which it is situated has depths of less than 6 feet (1m8). The *red* sector of Samiāni Island light covers the reef between bearings of 217° and 247°.

Chart 1321, plan of Okha.

Harbour.—Dangers.—Buoyage.—Pier.—In Okha harbour there are general depths of from 20 to 31 feet (6m1 to 9m4) except for a 16-foot (4m9) patch lying about 1¾ cables south-eastward of the head of the pier at Okha point; the patch is marked on its north-eastern and western sides by red can buoys.

Patches, with depths of 5 and 4 feet (1m5 and 1m2), lie on the coastal bank on the southern side of the harbour, about 2½ and 3¾ cables, respectively, southward of the head of the pier; the latter is marked by a black can buoy on its north-eastern side.

Southward of the above patches the harbour is encumbered with foul ground and shoals.

Sayaji pier, constructed of concrete and 400 feet (121m9) in length is situated close southward of Okha point; it is connected with the coast by a viaduct.

A depth of 26 feet (7m9) is maintained alongside the eastern side of the pier, where vessels of up to 540 feet (164m6) in length can berth; the western side of the pier can accommodate vessels of up to 325 feet (99m1) in length and about 13 feet (4m0) draught.

The pier is connected with the railway system and is equipped with two 1½-ton cranes.

Charts 1321, plan of Okha; 47

Anchorages.—Mooring buoys.—A vessel may obtain anchorage in a depth of 7 fathoms (12m8), in the outer roadstead, with Samiāni Island lighthouse, bearing 171°, distant about 1¼ miles.

A small vessel, with a draught of not more than 16 feet (4m9), may obtain anchorage south-eastward of Okha point. Strong north-easterly winds cause inconvenience to vessels working cargo in the anchorage.

There are two mooring buoys in the harbour about 2 cables east-north-eastward and 2½ cables south-eastward, respectively, of the head of Sayaji pier; No. 1 mooring buoy can accommodate vessels of up to 500 feet (152m4) in length and 21 feet (6m4) draught, whilst No. 2 mooring buoy is available to vessels of up to 400 feet (121m9) in length and 19 feet (5m8) draught.

Channels.—Caution.—Beacons.—There are three channels leading to Okha for which leading marks have been erected, one from the westward and two from the northward.

The eastern of the two channels from northward is the safest and more commonly used, but should not be attempted without local knowledge, as strong tidal streams set across the entrance.

Pilots are only available by day and none of the leading marks are lighted.

The western channel, known locally as the southern channel, leads over the south-western end of Samiāni shoal between the foul ground and shoal water extending northward from the coast between Vomani and Okha points, and the foul ground and shoal water extending southward and west-north-westward from the southern end of Samiāni island (*Lat. 22° 29′ N., Long. 69° 05′ E.*).

Charts 43, 39, 2736, 826, 1012, 748b.

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Charts 1321, plan of Okha; 47.

Two diamond-shaped beacons, the front one painted black and white and the rear one painted black, stand about 2¼ cables apart on Beyt island about 1¼ miles east-north-eastward of Padmatirth point; these two beacons in line, bearing 116°, lead through the western channel in a least depth of 16 feet (4m9). This channel is extremely narrow and difficult, owing to the strong tidal streams which set across it, and, consequently, is only used by coasting vessels and small craft with local knowledge.

The western of the two channels from the northward leads close north-westward of Samiāni island. Two triangular beacons, the front one painted black with a white circle, is situated about 1½ cables south-south-eastward of the northern extremity of Vomani point, and the rear one, painted black, stands about 3½ cables south-westward of the front beacon. These two beacons in line, bearing 231°, lead through the fairway of this channel in a least depth of 22 feet (6m7). This channel is seldom used and should not be attempted without local knowledge.

The eastern of the two channels from the northward leads close south-eastward of Samiāni island between the buoys marking the shoal waters extending south-eastward from Samiāni island and northward from Beyt island; the eastern extremity of Sayaji pier in line with a black beacon, surmounted by a disc, 30 feet (9m1) in height, situated on Adatra point, about 1¼ miles south-south-westward, bearing 206½°, leads through the fairway of this channel in a least depth of 18 feet (5m5). The entrance to this channel should not be approached too closely, and a vessel should embark the pilot in the position described on page 298.

The continuation of all three approach channels southward leads to the anchorage south-eastward of Okha point. The tomb on Padmatirth point in line with Dwarkadish temple (page 298), bearing 165°, leads through the fairway in a least depth of 19 feet (5m8).

The best time to enter or leave the harbour is about the time of slack water. At other times there is a strong race northward and southward of Samiāni island and, as the tidal streams are comparatively slack in the channels on each side of the island, a vessel is liable to take a sheer when entering or leaving this race. There is a heavy tide-rip on all the shoals, especially when the ebb tidal stream is running.

Tidal streams.—In the western approach channel to Okha the tidal streams set in an east-south-easterly direction with the flood and in a west-north-westerly direction with the ebb, attaining a rate of 3½ knots at neaps.

Northward of Samiāni island, and between it and Chinri reef, the tidal streams set in a south-easterly direction with the flood and in a west-north-westerly with the ebb; the flood stream attains a rate of 2½ knots at springs, and the ebb stream of 2 knots at neaps.

Westward of Samiāni island the tidal streams set in a north-easterly direction with the flood and in a south-westerly direction with the ebb, at rates of 1¾ knots at neaps; south-eastward of the island the reverse is the case.

The flood stream sets strongly round the southern end of Samiāni island (*Lat. 22° 29′ N., Long. 69° 05′ E.*) in a southerly and easterly direction, and from there sets southward through Okha harbour, curving in an easterly direction round the southern end of Beyt island;

Charts 43, 39, 2736, 826, 1012, 748b.

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Charts 1321, plan of Okha; 47.

it has a rate of from 1¼ to 1½ knots at neaps and of 2 knots at springs.

The ebb stream, coming from the eastward round the southern end of Beyt island, sets northward fairly through the harbour until it reaches the shoal water north-westward of Padmatirth point. Here it divides into two streams, one setting along the western side of the harbour and through the western approach channel, the other northward and north-eastward between Samiāni island and Beyt island and thence west-north-westward in the area northward of Samiāni island. The ebb stream has a rate of from 1¼ to 2 knots at neaps.

Strong eddies form in the harbour at springs with both tidal streams, and a confused sea occurs over the shallow ground north-westward of Padmatirth point. There is a strong undertow at the anchorage off Okha point.

Chart 1321, plan of Okha.

Okha.—The town of Okha is situated on Okha point. In 1960, it had a population of about 8,000.

Port facilities.—Small quantities of fresh provisions are obtainable. Water can be supplied from Sayaji pier at a rate of 50 tons a day or by water lighter at 20 tons a day.

Fuel oil can be made available by previous arrangement; it can be supplied from Sayaji pier or by lighter. Tankers discharge direct into the shore tanks.

No coal is available for bunkers.

Two tugs, twelve lighters, with capacities of 60 tons each, and three tank barges, with capacities of from 135 to 150 tons, are available.

In addition to the cranes on Sayaji pier, other cranes with capacities of from 3½ to 6 tons are available in the port.

Small repairs can be undertaken.

Storm signals.—Storm signals are displayed from the flagstaff on Okha point; the general system is used. *See* page 20.

Communications.—There is regular communication by sea with other coastal ports on the Indian peninsula.

There is an air service from Mithapur, about 9 miles from Okha, to Porbandar and Bombay.

Okha is connected with the general railway system.

Trade.—Shipping.—The principal exports are cement, chemicals, mineral oil, bauxite, salt and bleaching powder; the main imports are oil fuels, railway wagon components, iron and steel, timber and machinery.

In 1958-59, 242 vessels with a total net registered tonnage of 439,673 used the port.

Chart 47.

Positra bay.—Dangers.—Positra (Poshetra) bay is entered between the south-eastern point of Beyt island and Positra (Poshetra) point, about 3½ miles south-eastward; it is very shallow, and dries in places.

The southern shore of the bay, westward of Positra point (*Lat. 22° 25′ N., Long. 69° 12′ E.*), is low and much inundated at high-water springs. Landing is difficult, except at high-water springs, owing to the reefs and the sand and mud banks. The country is sparsely cultivated in parts, and mostly consists of sand and cactus scrub.

The village of Positra (Poshetra), situated about 2 miles south-westward of Positra point, stands on ground about 69 feet (21m0) high.

Charts 43, 39, 2736, 826, 1012, 748b.

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Chart 47.

Keu (Kiu) hills, about 4¾ miles westward of Positra point, the highest of which is 64 feet (19m5) high, consist of rock covered with cactus scrub. At high-water springs the adjacent country is flooded, and these hills are isolated; the beach on their northern side is the only place on this coast where landing is practicable at all states of the tide.

In the approach to Positra bay from the northward there are several shoals with depths of from 5 to 6 fathoms (9m1 to 11m0).

Paga reef, the southern extremity of which is situated about 3 miles north-eastward of Positra point, extends for about 4 miles in a north-westerly direction; on its south-western side, about 3¼ miles northward of Positra point, there is a sand ridge, which is only covered at high-water springs; the *red* sector of Samiāni Island light covers this reef between the bearings of 260° and 290°.

Charts 47, 43, 39.

The summit of Ajār, about 7¾ miles east-south-eastward of Positra point, in line with Great peak, the highest summit of the Bārdā range (page 274), leads close north-eastward of Paga reef. The south-eastern bluff, 120 feet (36m6) high, of Okhāmandal peninsula, about 9¼ miles south-south-westward of Positra point, bearing about 205° and seen between the two islets of Marudi bet, about 2½ miles south-south-eastward of the same point, leads close south-eastward of the reef.

Chart 47.

A detached 3-fathom (5m5) shoal is situated about 1¾ miles east-north-eastward of Hanuman point, the eastern extremity of Beyt island, and a similar shoal lies about 2 miles eastward of the same point.

Foul ground extends about 1¾ miles eastward from Positra point; Boria reef, situated at the eastern edge of this foul area, dries; a detached 2-fathom (3m7) shoal lies about 9½ cables north-eastward of Positra point; another small reef, the western edge of which is situated about 1¼ miles north-eastward of the same point, dries. Local knowledge is necessary when navigating in this vicinity.

On the southern side of the entrance to Positra bay, about 1¼ miles north-westward of Positra point and about three-quarters of a mile offshore, there is a reef, which is awash.

About 4 miles within the entrance of the bay the depths increase towards Shankholia point, the southern extremity of Beyt island, but there are some sunken rocks eastward of this point, and local knowledge is necessary when navigating here.

Anchorage.—During westerly gales well-sheltered anchorage may be obtained about half a mile from the eastern end of Beyt island with Hanuman point bearing 334°, distant 6 cables; eastward of this position the bottom is rocky.

Tidal streams.—The tidal streams at the anchorage set in a southerly direction with the flood and in a northerly direction with the ebb, attaining a rate of 1¼ knots at neaps and 1½ knots at springs.

Directions.—A vessel proceeding to the anchorage eastward of Beyt island can pass either westward or eastward of Chinri reef (*Lat. 22° 31′ N., Long. 69° 08′ E.*).

If intending to pass westward of the reef a vessel should pass close westward of No. 1 red can buoy, and then steer a south-easterly course until the sand ridge on the southern edge of Chinri reef bears 080°;

Charts 2736, 826, 1012, 748b.

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Chart 47.

course should then be altered eastward to pass about 3 cables southward of the sand ridge. The tidal streams in this vicinity set in an easterly and westerly direction at a rate of from 2½ to 3 knots. When Positra village bears 180° the vessel will be eastward of Hanumandanda reef, and the village should be steered for and kept on this bearing until Samiāni Island lighthouse bears 275°, when course may be altered towards the anchorage.

A vessel passing eastward of Chinri reef should bring Positra village to bear 180° and steer towards it, keeping it on that bearing, and proceed as above.

Chart 43.

Caution.—Navigation inshore of Burāl reef amongst the reefs and islets lying between Pindāra bay and Dhani bet, which are described in the following pages, should not be attempted without local knowledge.

Coast.—Dangers.—Light.—On the eastern side of Okhāmandal peninsula there is a Rann or salt-marsh, which is submerged at high spring tides, forming an almost impassable swamp. The Saurashtra coast (page 9) extends from this Rann in a general east-north-easterly direction to the head of the Gulf of Kutch.

Between Positra point and Shiārdi bet, about 9¼ miles south-eastward, is Pindāra bay, a large shallow bay, the head of which dries out to a distance of about 1½ miles; the town of Pindāra is situated at the head of the bay.

Quoin, about 135 feet (41m1) high, situated about 4 miles east-north-eastward of Pindāra and about half a mile inland, is the westernmost hill of the high land eastward of Okhāmandal peninsula. Westward of it the land is low and swampy, except in the vicinity of Pindāra. Northward and eastward of Quoin there are many small rocky hills rising out of the swamp, the sea-face of which is fringed with mangroves.

Garu bet, about half a mile eastward of Shiārdi bet, is 45 feet (13m7) high and prominent, being well defined by a black bluff on its eastern side. Kimra Kot bet, lies about half a mile northward of Shiārdi bet.

Charts 47, 43.

Boria and Paga reefs, eastward and northward of Positra point, are described on page 303.

Burāl or Chānka reef, the southern extremity of which is situated about 4¾ miles eastward of Positra point, is an extensive coral reef, which dries and extends about 8¼ miles northward and 11¼ miles north-eastward from its southern end; its northern side is steep-to. There are four islands and islets lying on this reef.

Chusra bet (*Lat. 22° 25′ N., 69° 17′ E.*), situated at the southern end of Burāl reef, about 2 cables within its southern extremity, is a small rocky islet.

Baida (Bida), the southern extremity of which is situated about 2¼ miles north-eastward of Chusra bet, is a mangrove island about 20 feet (6m1) high; its western side is sandy.

Chart 43.

Nora, the southern end of which lies about 2¼ miles north-north-eastward of Baida, is a low mangrove island, the highest trees of which are situated at its eastern end; the northern side of this island is sandy.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

Chānk, which is situated about 2¼ miles north-north-eastward of Nora, is a small wooded island.

A light, known as Chānk Island light, is exhibited, at an elevation of 30 feet (9m1), from a red steel framework tower on a concrete base, 25 feet (7m6) in height, situated on the northern edge of Burāl reef about one mile northward of Chānk island. For radar range *see* Appendix III on page 346.

Chart 47.

There is a deep channel between the eastern sides of Paga and Boria reefs, westward, and the western side of Burāl reef, eastward.

There is also a deep channel between Paga and Boria reefs, but local knowledge is necessary for a vessel using it.

Chart 43.

Marudi bet, about 2½ miles south-south-eastward of Positra point, and known locally as Sahn, lies about three-quarters of a mile offshore, and consists of two islets; the western and larger has a flat summit, 60 feet (18m3) high, while the eastern islet is conical-shaped; a detached 4-fathom (7m3) shoal lies about three-quarters of a mile north-eastward of the eastern islet.

About 1½ miles eastward of Marudi bet is a small detached reef which dries.

Ajār is a bluff island, 69 feet (21m0) high at its southern extremity, situated about 2¾ miles northward of Shiārdi bet; it is covered with jungle, and has a little cultivation. On the southern extremity of the island there is a round hill, on the summit of which stand the ruins of an old Mohammadan tomb.

Ajār is surrounded by a rocky reef, except on its south-eastern side, where the drying mudbank extends less than one cable from a high-water mark of white sand; this reef extends about 1¾ miles south-westward from the southern end, about 2½ miles westward from the western side, and about one mile northward and 1½ miles eastward from the northern end of the island.

There is a deep channel, about half a mile wide, westward of Ajār Island reef and another one, about 1¼ miles wide, on the northern side. In the fairway of the latter channel there is a rock, awash, and a shoal, with a least depth of 2½ fathoms (4m6), situated about 6 cables southward and 1¼ miles south-south-eastward, respectively, of Chusra bet (*Lat. 22° 25′ N., Long. 69° 17′ E.*); a drying reef also lies in the fairway of this channel about 2¼ miles east-north-eastward of Chusra bet; the channel southward of this reef is deep and about 1¼ miles wide. *See* caution on page 304.

Vudda Kudda reefs, the south-western end of which is situated about 2¼ miles north-north-eastward of Ajār island, consist of three detached drying reefs.

The channel between Vudda Kudda reefs and the south-eastern side of Burāl reef and the shoal ground extending therefrom is about half a mile wide and has a least depth of 4 fathoms (7m3) in the fairway. A sunken rock, which is steep-to, lies on the northern side of the fairway at the extremity of the shoal ground extending about 2½ miles south-eastward from Burāl reef.

Depths of 3½ fathoms (6m4) exist in the north-eastern approach to the above channel; the bottom in the approach is mostly mud.

Bubasir rock, about 2¼ miles south-eastward of Chānk, dries.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

The mangrove swamp continues for from 6 to 7 miles eastward of Shiārdi bet, and from thence to Salaya harbour, about 7 miles farther east-north-eastward, the land is slightly elevated, attaining an elevation in Simāni, a round hill about 9½ miles eastward of Shiārdi bet, of 100 feet (30^{m}5).

Gunjao Kudda, the western extremity of which is situated about 4 miles north-eastward of Shiārdi bet, is an extensive flat, with Panera island at its south-eastern end; Panera island is covered with mangrove bushes.

A small vessel can proceed at the time of high water between Gunjao Kudda and Vudda Kudda reefs, but the channel is shoal. A rock, with a depth of 6 feet (1^{m}8) over it, lies in the centre of the fairway. *Charts 3284, 43.*

An extensive drying flat, known as Dhani bet, the western extremity of which is situated about 1½ miles northward of Panera island, extends from the coast northward of Simāni hill in a northerly direction to a distance of about 5 miles; on this flat are situated Gāndhia and Dhani islands.

Charts 47, 43.

Tidal streams.—The tidal streams along the northern face of Burāl reef have a rate of from 4 to 6 knots and cause heavy tide-rips off the north-eastern end.

Westward of this reef, between it and Chinri and Paga reefs, the uneven bottom causes overfalls and tide-rips which at springs are alarming to a stranger.

The tidal streams are strong in some parts of the channels southward of Burāl reef, and local knowledge is necessary. The set of the stream during the first hour of the ebb, when it runs out over the reefs, is different from the direction it takes after half ebb, when confined within narrow deep channels.

Anchorages.—Dangers.—Small vessels can obtain good anchorage in depths of 4 fathoms (7^{m}3), mud, close westward of the north-western edge of Burāl reef, with the northern extremity of Nora island in line with the trees on Chānk (*Lat. 22° 32′ N., Long. 69° 24′ E.*), bearing 091°, and Chusra bet bearing 166°. The flood tidal stream is felt very little and the ebb not at all at this anchorage.

Shoals, with depths of 3 fathoms (5^{m}5) at their extremities, extend about half a mile westward and one mile south-westward from the north-western extremity of Burāl reef in the vicinity of this anchorage; a 3-fathom (5^{m}5) rocky patch lies about one mile southward of the anchorage.

Chart 43.

A small vessel with local knowledge can obtain good anchorage about half a mile eastward of Marudi bet, also on its western side, in depths of from 6 to 9 fathoms (11^{m}0 to 16^{m}5), mud, sheltered from all winds. This anchorage can be approached by the deep channel eastward of Paga reef; see page 303 for clearing marks.

There is good shelter on the eastern and south-eastern sides of Burāl reef during westerly winds; a vessel anchoring on the eastern side of the reef must take care to avoid Bubasir rock.

A vessel taking shelter for a single tide only can anchor in depths of from 8 to 9 fathoms (14^{m}6 to 16^{m}5), mud, just on the edge of the shoal soundings, with the trees on Chānk island, bearing 271°, distant

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Chart 43.

about 2 miles; or, farther south-eastward, in depths of from 6 to 7 fathoms (11m0 to 12m8), mud, with the trees, bearing 293°, distant about 3 miles. The ebb tidal stream at this latter anchorage sets in a north-westerly direction, and the flood in a south-easterly direction.

Anchorage can be obtained in a depth of 5 fathoms (9m1), mud, about 2 miles south-eastward of Chānk island.

Large native vessels seek shelter to leeward of Chānk during the south-west monsoon.

A vessel proceeding to an anchorage on the eastern side of Burāl reef, and passing northward of this reef, should keep a good look-out for the trees on Nora and Chānk; these islands should be given a berth of about 3 miles.

Small vessels with local knowledge can anchor off the south-eastern side of Ajār island (*Lat. 22° 23′ N., Long. 69° 20′ E.*).

Chart 3284.

Salāya harbour.—Salāya harbour is entered between the drying coral reefs which extend north-eastward from Dhani island and south-westward from Kārumbhar island, the western extremity of which is situated about 4¼ miles eastward of the northern end of Dhani island.

The harbour extends about 6 miles in a south-easterly direction, with an average width of from 7 to 8 cables, and has depths of from 5¾ to 14 fathoms (10m5 to 25m6) in the entrance, gradually shoaling to 5 fathoms (9m1) about 5 miles within.

A bar of soft mud extends across the approach, in the fairway of which there is a least depth of 29 feet (8m8). The continuation of the harbour in an easterly direction, known as Blunt channel, leads about 1¼ miles southward of Kārumbhar island into Pathfinder inlet (page 310); another branch of the harbour extends southward, forming Salāya creek.

Charts 3284, 43.

Islands and dangers.—Light.—Beacons.—The harbour entrance is not easily identified when the reefs are covered, as Dhani and Kārumbhar islands present no distinctive features.

Dhani island is a flat of sand and mud, fringed with mangrove scrub, and, with the exception of some sand ridges at its northern end, is submerged at high-water springs.

A sandbank, close north-westward of the northern end of Dhani island, dries from 10 to 16 feet (3m0 to 4m9); the coral reef surrounding the island extends from one to 1½ miles north-eastward from its north-eastern side, and dries 10 feet (3m0).

Kārumbhar island is similar in composition to Dhani island. A low narrow ridge of sand, covered with low scrub, extends along the northern side of the island.

Kārumbhar reef surrounding Kārumbhar island extends south-westward from its south-western side and northward from its northern side for about 1¼ miles. This reef, which covers at half flood tide, consists of hard dead coral with, in places, flats of very soft mud which are dangerous to walk on at low water.

Chart 3284.

A light is exhibited, at an elevation of 60 feet (18m3), from a circular stone tower, 45 feet (13m7) in height, situated at the western extremity of Kārumbhar island (*Lat. 22° 26′ N., Long. 69° 35′ E.*).

Wooden pole beacons, 2 feet high, mark the edges of the reefs on

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Chart 3284.

either side of the channel as indicated on the chart; they cannot however, be relied on as they are only intended for the guidance of local craft and they are not always standing. Similar beacons mark the entrance and head of Salāya creek.

A pair of white stone leading beacons, 8 feet (2^{m}4) high and 5 cables apart, stand on the western side of the entrance about 2½ and 3 miles, respectively, westward of Kārumbhar Island light-tower; in line they bear 302°.

A similar pair of beacons, about 3½ cables apart, stand on the western side of the channel about 2 miles south-eastward of the first-mentioned pair; in line they bear 164°.

Taylor shoal, with a depth of 3¾ fathoms (6^{m}9), lies on the bar in the approach to the harbour about 3¼ miles west-north-westward of Kārumbhar Island light-tower.

Hand shoals, consisting of two 4½-fathom (8^{m}2) patches, lie about half a mile south-south-westward and three-quarters of a mile south-south-eastward of Taylor shoal.

A large flat, with depths of from 2¾ to 4 fathoms (5^{m}0 to 7^{m}3), extends eastward from Taylor shoal and joins the drying reef extending north-westward from Kārumbhar island; westward of Taylor shoal the flat has depths of from 4½ to 5¾ fathoms (8^{m}2 to 10^{m}5).

Two shoals, each with a depth of 5¾ fathoms (10^{m}5), lie about 1¾ miles westward and west-south-westward, respectively, of Kārumbhar Island light-tower.

Nora rock (*Lat. 22° 26′ N., Long. 69′ 34′ E.*), on the eastern side of the harbour about 1½ miles south-westward of Kārumbhar Island light-tower, has a least depth of 7 feet (2^{m}1), coral, over it; a tongue, with a least depth of 23 feet (7^{m}0) over it, extends about 5 cables westward from the rock, restricting the channel to a width of less than 2 cables.

A shoal, with a depth of 4¼ fathoms (7^{m}8), lies nearly 1½ miles south-south-westward of Kārumbhar Island light-tower; shoals with depths of 5¼ and 5¾ fathoms (9^{m}6 and 10^{m}5) lie about 1¾ miles southward of this light-tower.

Sinclair reefs, consisting of dead coral which dries, lie on the mud banks at the head of the harbour in the entrance to Salāya creek and Blunt channel.

Tidal streams.—The tidal streams in Salāya harbour set in a south-easterly direction with the flood tide and in a north-westerly direction with the ebb, attaining a maximum rate of 2 knots at the entrance to the harbour.

At a distance of from 2 to 3 miles outside the entrance, the tidal streams set in an easterly direction with the flood tide and in a westerly direction with the ebb, attaining a rate of one knot at neaps.

Anchorages.—A large vessel can obtain anchorage in Salāya harbour, in a depth of about 8 fathoms (14^{m}6), either in the outer anchorage, about three-quarters of a mile north-north-westward of Nora rock, or, if possessing local knowledge, in the inner anchorage about 2 miles southward of Kārumbhar Island light-tower.

Small craft with local knowledge can find anchorage, in a depth of about 4 fathoms (7^{m}3), about 1½ miles northward of Sykes point situated at the junction of Salāya creek and Blunt channel.

Charts 3284, 43.

Directions.—A vessel of deep draught approaching Salāya harbour

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Charts 3284, 43.

from north-westward should, after passing Chānk Island lighthouse (page 305), steer for Kārumbhar Island light-tower bearing 128°; this course should be maintained until the south-eastern beacon of the northern pair of white stone leading beacons on the western side of the harbour entrance bears 152°, when she should steer for it on that bearing. When Kārumbhar Island light-tower bears 114° she should steer for it on that bearing; this leads between Taylor and Hand shoals. When the northern of the southern pair of white stone leading beacons bears 158° she should keep it so; this leads to the outer anchorage. A vessel of deep draught should not proceed southward of Nora rock without local knowledge.

A vessel of light draught, after passing between Taylor and Hand shoals as directed above, should keep Kārumbhar Island light-tower bearing 114° until the southern pair of white stone leading beacons are in line, bearing 164°, when she should keep them so until the northern pair of white stone leading beacons come into line astern, bearing 302°; this latter pair of beacons, in line, lead to the inner anchorage. Local knowledge is necessary for proceeding to the anchorage northward of Sykes point.

Salāya.—Salāya (*Lat. 22° 19′ N., Long. 69° 36′ E.*) is a small town at the head of Salāya creek, 3½ miles above that part of the creek which can be reached by boats at low water. It is closely built with small stone houses and surrounded by a wall about 40 feet (12^{m}2) high, at the north-western corner of which are the remains of a fort.

Local vessels proceeding up the Gulf of Kutch call here regularly.

Khambhāliya.—The town of Khambhāliya is situated about 6½ miles southward of Salāya, and contains several old temples. It is connected with the general railway system.

Ghi river flows westward of Khambhāliya and Salāya into Salāya harbour.

Sykes point.—Sykes point, at the junction of Salāya creek and Blunt channel, is the only place in the harbour, having direct communication with Salāya and Khambhāliya, at which landing is possible. A pier, about 4¼ cables long, extends northward from the point and is connected with the railway system; boats and lighters can go alongside the pier for 2 hours on either side of high water, after which the reef at the head of the pier dries; fresh water is laid on to the pier. A small jetty, which can be used by boats at or near high water, extends west-north-westward from the western side of Sykes point.

On the eastern side of the entrance to Salāya creek, about 1¼ miles southward of Sykes point (*Lat. 22° 22′ N., Long. 69° 37′ E.*), is another pier which can be used by boats at any state of the tide except low-water springs, but the channel leading to it from northward is difficult when the reefs are covered.

Chart 43.

Blunt channel.—Beacons.—Blunt channel, southward of Kārumbhar island, connects the head of Salāya harbour with Pathfinder inlet, eastward of the island. The channel can be used by small craft of 6-foot (1^{m}8) draught at any state of the tide, but it is narrow, tortuous and, when the reefs and mud flats are covered, difficult to distinguish. The northern side of the channel is marked by three wooden pole beacons, 2 feet (0^{m}6) high which cannot, however, be relied on.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

Pathfinder inlet. — Dangers. — Beacons. — Anchorage. — Tidal streams.—Pathfinder inlet lies off the eastern side of Kārumbhar island between Kārumbhar reef, westward, and Narāra reef, eastward; it is from 2 to 3 cables wide, with depths of 15 fathoms (27m4) in the entrance, decreasing to 6 fathoms (11m0) about 1½ miles within; southward of this position the inlet is connected with Salāya harbour by Blunt channel, described above.

Tilburn shoal, with a depth of 23 feet (7m0), lies about 1½ miles north-eastward of the northern extremity of Kārumbhar island.

A wooden beacon, 2 feet (0m6) high, stands on Kārumbhar reef, about a quarter of a mile within the entrance; another wooden beacon stands on a sandhill on Narāra reef, about 4½ miles eastward of the northern extremity of Kārumbhar island.

An isolated reef, which dries 4 feet (1m2), lies on the eastern side of the entrance, about half a mile north-eastward of the beacon on Kārumbhar reef.

Other objects prominent from seaward, in this vicinity, are a solitary mangrove tree standing on the eastern extremity of Kārumbhar island, and Āmbla hill, 80 feet (24m4) high, situated about 5 miles southward of the entrance.

Sheltered anchorage can be found during the south-west monsoon, in a depth of 10 fathoms (18m3), mud, about three-quarters of a mile northward of the entrance to the inlet, under the lee of Kārumbhar island. A small vessel, with local knowledge, can anchor, in a depth of 11 fathoms (20m1), about one mile within the entrance.

At the latter anchorage the tidal streams attain a maximum rate of 3 knots.

Coast. — Dangers. — Lights. — Buoy. — Beacons. — Narāra bet, about 3 miles eastward of Kārumbhar island, consists of an islet joined to the mainland southward by a mangrove swamp; a clump of trees fronted by sand stand on the islet.

Narāra reef, which dries 10 feet (3m0), extends about 1¼ miles north-westward and northward and 2 miles north-eastward from Narāra bet (*Lat. 22° 27′ N., Long. 69° 43′ E.*).

Charts 1321, plan of Sika Kāri; 43.

Goos reef, the western extremity of which is situated about 3½ miles east-north-eastward of the northern extremity of Narāra bet, has on it a long sandbank that dries before the reef itself, and is prominent. A bank, with depths of less than 6 fathoms (11m0), extends nearly one mile north-westward from the north-western side of the reef; the whole area, for a distance of about 3 miles south-eastward from Goos reef, covers at high water.

The channels between Goos reef and the reefs extending from the mainland are used by native vessels when it is blowing very fresh, to avoid the heavy sea outside.

Sika kāri, a creek on the western side of Goos reef, has depths of from 5 to 7 fathoms (9m1 to 12m8) in the fairway for a distance of about 2 miles within the entrance; the head of the creek shoals rapidly to depths of less than one fathom (1m8); the deepest part of the channel lies near the entrance between the western extremity of Goos reef and Siri reef, a detached drying reef about 7 cables south-westward; for anchorage, *see* page 312. The creek is only navigable for about 3 miles at low water, but, at high water, large native boats pass through

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Chart 3281, plan of Sika Kāri; 43.

channels amongst the mangrove bushes almost in a direct line to Rozi island, about 18 miles east-north-eastward of Narāra bet, and thence to Bedi docks, the port of Jāmnagar, about 2½ miles southward.

At Sika, on the mainland about 4¾ miles south-eastward of the western end of Goos reef, there is a cement factory with two tall chimneys.

Leading lights, about 4¾ cables apart, are exhibited at the factory, at elevations of 57 and 102 feet (17m4 and 37m1), the rear light from the eastern of the two tall chimneys. These lights in line, bearing 138° lead to the anchorage (page 312) in Sika kāri.

There is a tide gauge at the head of the creek, about 1½ miles west-north-westward of the front leading light.

Chart 43.

Dēra, a mangrove islet with a range of low sandhills, is situated about 2½ miles north-eastward of the northern extremity of Goos reef; the north-western end of this islet is a bluff, about 15 feet (4m6) high.

A drying reef extends about 1½ miles westward, about three-quarters of a mile northward, and about 4½ miles north-eastward from the north-western extremity of Dēra; the western part of this reef is known as Dēra reef. A bank, with depths of less than 6 fathoms (11m0), extends about 2½ miles westward and 1½ miles north-north-westward from the western extremity of Dēra.

Sarmat kāri flows into the gulf about 4½ miles north-eastward of the north-western end of Dēra.

Pirotan island, the western extremity of which lies about 6½ miles north-eastward of the north-western end of Dēra, is a good landmark as the trees on it are not allowed to be cut down; this island lies about one mile from the mainland to which it is connected by a drying coral reef. This coral reef extends about three-quarters of a mile west-south-westward from the western extremity of Pirotan island, about 1¼ miles north-eastward from its northern side, and about one mile eastward from its eastern extremity.

A light is exhibited, at an elevation of 73 feet (22m3), from a white circular tower with black bands, 60 feet (18m3) in height, situated on Pirotan island (*Lat. 22° 36′ N., Long. 69° 57′ E.*).

A light is exhibited, at an elevation of 18 feet (5m5), from an iron framework beacon on a stone base, 28 feet (8m5) in height, on the edge of the reef about 1¼ miles north-eastward of Pirotan Island light.

Charts 1779, plan of Rozi; 43.

Rozi island, rocky and 37 feet (11m3) high, lies about 5 miles south-eastward of Pirotan island. Pirotan swamp, consisting of sand and mud flats intersected by creeks and fringed with mangroves, lies south-eastward of Pirotan island and extends about 3½ miles south-eastward to Bedi creek; on the north-eastern face of the swamp is a prominent sandspit.

Chart 1779, plan of Rozi.

Rozi Māta temple stands at the northern end of Rozi island.

A light is exhibited, at an elevation of 48 feet (14m6), from a white circular tower, 50 feet (15m2) in height, situated on the north-western corner of Rozi Māta temple courtyard. This light is known as Rozi Māta light.

Ranson shoal, with a least depth of 5 feet (1m5), lies about 4 miles northward of Rozi Māta lighthouse; a red conical buoy is moored on

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Chart 1779, plan of Rozi.

the western side of the shoalest part; shoal water, with depths of less than 3 fathoms (5m5), extend about 8 cables westward and 6½ cables east-south-eastward from the buoy.

A detached reef, which dries 3 feet (0m9), lies with its southern extremity about 2¼ miles northward of Rozi Māta lighthouse.

A light is exhibited, at an elevation of 25 feet (7m6), from Kalvan beacon, a white masonry pillar with black bands, situated on the north-eastern extremity of the above detached reef.

Bedi creek flows into the gulf about one mile northward of the northern end of Rozi island; its entrance is marked by two small white masonry beacons, the southernmost of which stands on the head of a stone jetty extending north-north-westward for about three-quarters of a mile from Rozi railway station. The railway runs close westward of the jetty, the seaward ends of both rail and jetty covering at half tide; the eastern side of the jetty can be used at any state of the tide except low-water springs. The creek southward of the entrance beacons dries, but tugs, boats and lighters can proceed up the creek beyond Bedi docks at high water.

A light is exhibited, at an elevation of 25 feet (7m6), from a white masonry pillar with red bands at the head of the above stone jetty.

Chart 1321, plan of Sika Kāri.

Anchorages.—Directions.—Sika kāri provides sheltered anchorage for vessels with local knowledge in a depth of 6 fathoms (11m0) about half a mile within the entrance between the western end of Goos reef and Siri reef; the leading lights at Sika, bearing 138°, lead to this anchorage.

The creek should not be entered except at nearly low water, when all the reefs will be uncovered and care should be taken to avoid the shoal, with a least depth of 2 fathoms (3m7), lying about 2 cables eastward of Siri reef.

Chart 43.

Small craft with local knowledge can obtain anchorage in Sarmat kāri, south-westward of Pirotan island (*Lat. 22° 36′ N., Long. 69° 57′ E.*) in depths of from 4 to 5 fathoms (7m3 to 9m1), mud. It would not be prudent to enter the creek until about 2 hours after the time of high water, when the edge of the reef dries. There are some rocky patches about three-quarters of a mile within the entrance.

Chart 1779, plan of Rozi.

Small craft with local knowledge may obtain anchorage about half a mile north-eastward of Kalvan light-beacon in depths of 3 fathoms (5m5), mud; this anchorage is well sheltered from the westerly winds which prevail from February to October inclusive.

A large vessel with cargo for Bedi docks may anchor about 1½ miles north-north-eastward of Kalvan light-beacon in depths of 6 fathoms (11m0), mud.

Vessels approaching from the westward, and bound for one of the above anchorages off Kalvan light-beacon, should not alter course until the light-beacon bears 185°, so as to avoid the reefs and shoal water extending offshore between Pirotan island and Rozi island, as far eastward as Ranson shoal. Local knowledge is necessary, as the ground is rocky eastward of the anchorage. Vessels entering or leaving these anchorages should keep northward of the red conical buoy

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Charts 1779, plan of Rozi.

marking Ranson shoal, and bear in mind that shoal water extends about 6½ cables east-south-eastward from the buoy.

Bedi.—Bedi docks, about one mile north-westward of Bedi village, form the port for Jāmnagar, with which they are connected by a railway; the port is open throughout the year.

There is regular communication by sea with Europe, and with other Indian ports.

Pilotage.—No pilots are available but local guides can be provided on request between Pirotan island and the anchorages off Kalvan light-beacon.

Port facilities.—Tugs and lighters are available; one of the tugs is equipped for salvage work.

There is a basin, which dries at half tide, with about 10,000 feet (3,047^{m}9) of quayage connected with the railway system, where lighters are loaded and discharged. Cranes and derricks with lifting capacities of from 2 to 14 tons are available.

There is a limited supply of provisions, vegetables and fruit. Up to 15 tons daily of fresh water, suitable only for use in boilers, is obtainable on application to the port authorities.

Small repairs can be carried out.

Storm signals.—Storm signals are displayed from the vicinity of Rozi Māta light-house; the brief system is used. *See* page 20.

Trade.—Shipping.—The principal exports are wool, salt, oil cake, ground nut oil and bauxite; the main imports are cottonseed, coal, coke, food grains, iron, steel and petroleum products.

In 1958-59, 170 vessels with a total net registered tonnage of 459,980 used the port.

Chart 43.

Jāmnagar.—The city of Jāmnagar (*Lat. 22° 28′ N., Long. 70° 06′ E.*), which is the headquarters of Jāmnagar district, is situated about 4 miles south-eastward of Bedi docks. In 1951, it had a population of 104,419.

There are two hospitals and dispensaries, which are open to seamen.

Kota tower, circular and 175 feet (53^{m}3) high, stands on the western side of the fort at Jāmnagar, and is prominent.

Pratap villas palace clock tower, 172 feet (52^{m}4) high, situated about midway between Jāmnagar and Bedi, and two radio masts, 120 feet (36^{m}6) high, about 1½ miles south-eastward of Bedi docks, are also prominent.

Rangmati river flows into the gulf about 2½ miles north-north-westward of the city.

Communications.—Jāmnagar is connected with the general railway system.

There is a regular air service to Bombay.

Coast.—Dangers.—Light.—Beacon.—Eastward of Rozi Māta lighthouse, sand and mud flats, intersected by creeks and fringed with mangroves, extend about 4 miles offshore as far eastward as Sachāna, a village on the coast, about 6½ miles eastward of the lighthouse.

Dhuwāo town lies about 3½ miles east-north-eastward of Jāmnagar and about 1¼ miles inland.

The entrance to the creek leading to Dhuwāo lies about 4 miles northward of the town, amongst mangrove bushes; the mud bank at the mouth of the creek dries out to the distance of about 1½ miles.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

About 1½ miles east-south-eastward of Dhuwāo there is a low table hill, about half a mile long, and 1½ miles farther eastward are two mounds named The Paps.

A small range of rocky mounds, 40 to 50 feet (12m2 to 15m2) high, front the coast, about 3 miles north-north-eastward of Sachāna; they are isolated at high-water springs.

Bālāchiri is a small village about 2¾ miles north-north-eastward of Sachāna; thence a range of hills, which attains an elevation of 100 feet (30m5), trends in a south-easterly direction, and terminates rather abruptly about 1½ miles from the village.

The town of Hariāna is situated about 2½ miles eastward of Bālāchiri.

About three-quarters of a mile north-north-westward of Bālāchiri, there is a small conical hill, detached from the mainland, and isolated at high water, on the summit of which stands a Mohammadan fakir's place, named Ākria Pir.

Between Bālāchiri and Ākria Pir there is a creek, off the mouth of which lies a rock, which dries 10 feet (3m0); the coastal reef, which dries, extends about 1½ miles westward from this rock.

From Ākria Pir the coast trends in a north-north-easterly direction for about 6½ miles to a low sandy point, and is fringed by the coastal reef, which extends to a distance of about 3 miles offshore.

A coral reef, which dries, is situated about 3½ miles west-north-westward of Ākria Pir.

Bālāchiri rocks, about 4 miles north-north-westward of Ākria Pir, lie from about 2¾ to 4½ miles offshore, and dry. For radar range *see* Appendix III on page 346.

Jodiya fort is situated 7 miles north-eastward of Ākria Pir and 2¾ miles inland; the north-western bastion, 80 feet (24m4) high, and the Durbar house, close south-eastward of the fort, are prominent. These objects identify the place unmistakably, and may be seen, in clear weather, from a distance of from 10 or 12 miles. Jodiya bandar (*Lat. 22° 43′ N., Long. 70° 17′ E.*) is situated about 2 miles north-westward of the fort.

The entrance to Jodiya creek lies amongst mangroves about one mile northward of Jodiya bandar. Small craft with local knowledge can enter Jodiya creek but those drawing over 6 feet (1m8) can only do so after half-flood.

A light is exhibited, at an elevation of 36 feet (11m0), from a metal column, 32 feet (9m8) in height, situated on the extremity of the northern end of the quay wall at Jodiya bandar.

Charts 1318, 43.

Mungra reef, the western edge of which lies about 8¼ miles north-westward of Jodiya fort, is situated at the western edge of the drying coastal reef, which, between the low sandy point mentioned above and the entrance to Hansthal creek, about 15 miles north-north-eastward, extends from about 1½ to 5 miles offshore.

About three-quarters of a mile within the western extremity of Mungra reef there is a heap of sand and shells, which is the first part that dries, and then identifies the position of the reef. A prominent masonry beacon, 12 feet (3m7) in height, stands on a small detached drying reef close southward of the western extremity of Mungra reef.

There are several shoals, with depths of less than 6 feet (1m8), in the approaches to Hansthal creek; these are described on page 324.

Charts 39, 2736, 826, 1012, 748b.

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Chart 43.

Anchorages.—Directions.—Bālāchiri roads, north-westward of Ākria Pir, may be approached with Ākria Pir bearing 120°, on which bearing a vessel may anchor, during the north-east monsoon, in depths of from 3 to 5 fathoms (5^{m}5 to 9^{m}1), according to her draught. The bottom is soft mud, and the anchorage is protected from north-easterly gales by the reefs northward, but local knowledge is necessary for navigating this part of the gulf.

A vessel may anchor in a depth of 3 fathoms (5^{m}5), mud, sheltered from strong north-easterly winds, with Mungra beacon bearing about 003°, distant about 1½ miles, and Jodiya fort 109°.

Charts 43, 39.

NORTHERN SIDE OF GULF.—Aspect.—Āsār Māta is a conspicuous Hindu temple, 83 feet (25^{m}3) in height, standing at an elevation of 113 feet (34^{m}4) on the coast at what may be considered the northern entrance point of the gulf, about 23 miles north-north-eastward of Vomani point (page 298).

A range of hills, situated about 15 to 20 miles inland, extends in an easterly and westerly direction for about 35 miles, nearly parallel with the coast.

Krikubbah (*Lat. 23° 09′ N., Long. 69° 15′ E.*) is a sharp peak, 830 feet (253^{m}0) high, situated about 18 miles northward of Āsār Māta.

Nanu or Nunnomar hill, about 6½ miles east-north-eastward of Krikubbah, is round-shaped and 1,280 feet (390^{m}1) high.

Katrūra, 1,000 feet (304^{m}8) high and also round-shaped, lies about 24 miles eastward of Nanu hill. It is the highest of the eastern peaks of this range and may sometimes be seen from the southern side of the gulf.

Chart 43.

Coast.—Dangers.—Āsār Māta, situated on the crest of the sand-hills, is described above.

The coast between Āsār Māta and Māndvi, about 7 miles eastward, is fronted with white sandhills, between 20 and 50 feet (6^{m}1 and 15^{m}2) high, which at night are very prominent.

About 3¾ miles eastward of Āsār Māta stand Vijay Villas palace, Tamāchi Pir tomb and a house; all are conspicuous.

Tamāchi Pir, a Mohammadan tomb, stands at an elevation of 86 feet (26^{m}2) on a sandhill; the eastern end of the sandhill consists of a steep bluff with a small creek at its foot.

Between Āsār Māta and Māndvi the coastal bank and some detached shoals, each with depths of 3 fathoms (5^{m}5) or less, extend between 1½ and 2 miles offshore. The dangers westward of Āsār Māta are described on page 326.

Outlying shoals.—Light-and-bell-buoy.—Clearing marks.—A shoal, with depths of from 4¼ to 5¼ fathoms (7^{m}8 to 9^{m}6) lies about 5½ miles south-south-eastward of Āsār Māta; scattered detached shoals, with depths of from 5 to 5¾ fathoms (9^{m}1 to 10^{m}5) lie within 1½ miles west-south-westward, 2½ miles north-westward and 2½ north-eastward of the western end of this shoal; their positions may best be seen on the chart.

Ranwara shoals, lying about 6 miles southward of Māndvi breakwater (*Lat. 22° 49′ N., Long. 69° 21′ E.*), consist of two rocky shoals, each with depths of less than 6 fathoms (11^{m}0) and separated from each

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Chart 43.

other by a narrow gut, with depths of 6 to 9 fathoms (11^{m}0 to 16^{m}5).

The north-western shoal is about 5¼ miles long in an easterly and westerly direction; it has an area at its eastern end with depths of from 2 to 3 fathoms (3^{m}7 to 5^{m}5) and two 3-fathom (5^{m}5) patches about 3 miles east-north-eastward and 2 miles eastward, respectively, of its western extremity.

The south-eastern shoal, on which the sea always breaks, is a broken rocky ridge, about 3½ miles long in a north-westerly and south-easterly direction; it has an area at its north-western end, with depths of from 3 to 13 feet (0^{m}9 to 4^{m}0), and three patches at its south-eastern end with depths of 3 fathoms (5^{m}5) or less.

A red can light-and-bell-buoy, exhibiting a *red flashing* light *every ten seconds*, is moored off the southern side of the eastern end of the south-eastern shoal.

Rawal Pir lighthouse (page 317), about 1¾ miles east-south-eastward of Māndvi, in line with Nanu hill, bearing 353°, leads eastward of Ranwara shoals.

Tidal streams.—The tidal streams over Ranwara shoals attain a rate of 5 knots at springs and 3 knots at neaps; they cause heavy tide-rips and overfalls over the uneven ground in the vicinity and westward towards Āsār Māta.

Māndvi harbour.—Lights.—Māndvi harbour lies at the entrance to Rukmāwati river; the town, standing on the western bank, is surrounded by a wall flanked with bastions, within which is a palace a large flat-roofed building that forms a prominent landmark.

A light is exhibited, at an elevation of 103 feet (31^{m}4), from a white masonry tower with red bands, 56 feet (17^{m}1) in height, situated on the south-western bastion of Māndvi fort (*Lat. 22° 50′ N., Long. 69° 21′ E.*).

The harbour is protected against westerly winds by Albert Edward breakwater, 1,850 feet (563^{m}9) long; craft of from 9 to 10 feet (2^{m}7 to 3^{m}0) draught, with local knowledge, can enter the harbour at high-water neaps. There is a pier and pitched slope, where boats can secure alongside and work cargo, but this can only be done at high water as the entire harbour dries out at half tide.

A light is exhibited, at an elevation of 25 feet (7^{m}6), from the head of Albert Edward breakwater.

Anchorage.—Good anchorage may be obtained about 1½ miles southward of Albert Edward breakwater, with Rāwal Pir lighthouse (page 317) bearing 063°, in a depth of 3¾ fathoms (6^{m}9), clay, or farther offshore, according to the draught of the vessel.

Tidal streams.—The tidal streams at the anchorage off Māndvi attain a rate of 3 knots at springs, and of less than 2 knots at neaps; farther offshore they increase in strength.

Māndvi.—Communications.—Māndvi is the most important commercial town in the Gulf of Kutch. In 1951, it had a population of 29,305.

The town is connected by road with Bhuj, the headquarters of Kutch district about 31 miles north-eastward, from where there is a regular air service to Bombay.

There is regular communication by sea with Bombay and Karāchi.

Pigeons and peacocks are numerous in and around the town, and strangers would give great offence to the Banias and Bhatias, who form part of the population, if they were to kill these birds.

Charts 39, 826, 748b.

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Chart 43.

Port facilities.—Water is scarce and provisions are in short supply. One tug and twelve lighters, with capacities of from 60 to 100 tons, are available.

Storm signals.—Storm signals are displayed by day only from the flagstaff at the customs house at Māndvi; the general system is used. *See* page 20.

Trade.—Shipping.—The principal exports are food grains, pulses and googal; the main imports are cement, molasses, timber, building materials, iron, steel and fuel oils.

In 1958-59, 66 powered vessels and 713 sailing vessels with total net registered tonnages of 104,954 and 31,737, respectively, used the port.

Coast.—Dangers.—Lights.—Beacons.—Between Māndvi and Mudwah point, about 7¾ miles east-south-eastward, the coast is fringed for about 7¼ miles by a sandbank, which extends in places about three-quarters of a mile offshore; from thence the coastal reef extends nearly half a mile offshore.

A light is exhibited, at an elevation of 58 feet (17^{m}7), from Rāwal (Raval) Pir tomb situated on the coast about 2½ miles eastward of Māndvi.

In the vicinity of Rāwal Pir tomb there are some sandhills with a clump of trees on them.

Two 17-foot (5^{m}2) patches lie about 2 miles southward and 2¾ miles south-south-eastward of Rāwal Pir tomb and about 1½ miles offshore.

Mudwah point (*Lat. 22° 46′ N., Long. 69° 28′ E.*) is a sandy bluff, 41 feet (12^{m}5) high, with a ledge of drying rocks extending about 3½ cables southward from it. Northward of this point is an extensive backwater that runs to within 2 miles of Rāwal pir, and which is entirely flooded at ordinary high water during the south-west monsoon, but, at other times, only at very high spring tides.

Between Mudwah point and Navinar point, on which there is a lighthouse, about 12 miles eastward, there are long narrow ridges of sand, from 5 to 10 feet (1^{m}5 to 3^{m}0) high, fronting the coast, and from which a drying bank extends about one mile to seaward; between these sand ridges and the mainland there is an extensive swamp, which is covered with mangroves, and intersected by numerous small creeks.

Sonar Durree, a sandbank lying from 4 to 7 miles east-south-eastward of Mudwah point, consists of detached ridges of sand, which dry; it is steep-to on its southern side, with depths of 10 fathoms (18^{m}3) 2 or 3 cables southward of it. During the first half-flood, and after half-ebb, the bank may be identified by the rippling of the water, and invariably from the masthead by the discoloured water over it. There is no navigable passage northward of this sandbank.

Navinar lighthouse, bearing more than 070°, is obscured over Sonar Durree.

Navinar point consists of a few ridges of sand, the highest part of which is not more than 10 feet (3^{m}0) high.

A light is exhibited, at an elevation of 50 feet (15^{m}2), from a white stone tower with black bands, 60 feet (18^{m}3) in height, situated on Navinar point.

About 5½ miles west-north-westward of Navinar lighthouse, on a low point, is a sandhill, 63 feet (19^{m}2) high.

A large swamp, partly covered with mangrove bushes, extends about 5½ miles north-westward, 3½ miles northward, and 5½ miles

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Chart 43.

north-eastward from Navinar point; several small creeks flow into the gulf through this swamp.

Navinar and Bocha creeks flow into the gulf through a common entrance on the north-eastern side of Navinar point. The entrance to Navinar creek, the western one, has completely silted up.

Bocha creek has a bar across the entrance with a least depth of one foot (0m3); the entrance is surrounded by mangrove bushes. Small wooden jetties, where shallow-draught barges can load, lie on the eastern bank of the creek at Mundra New port, about 1½ miles north-westward of the entrance; over forty thousand tons of salt are exported annually from this minor port.

Mundra creek, the entrance to which dries, flows into the gulf about 2¾ miles north-north-eastward of Navinar Point lighthouse (*Lat. 22° 45′ N., Long. 69° 43′ E.*); about three-quarters of a mile within the entrance, which is surrounded by mangrove bushes, lies the old bandar house, which is isolated at high-water springs. Mundra fort, which encloses the town of Mundra, is situated about 2½ miles northward of the old bandar house; a white mosque and a grove of coconut trees stand about half a mile westward of the fort.

Between Navinar point and the entrance to Nakti creek, about 26 miles east-north-eastward, the coast is fronted by a mud flat which dries up to 3 miles offshore.

Two shoals, with least depths of 2 and 3 fathoms (3m7 and 5m5), lie with their south-western extremities about 2½ miles eastward and 6 miles east-north-eastward, respectively, of Navinar Point lighthouse; they extend about 2½ and 2 miles north-eastward from their south-western extremities. A shoal, with a least depth of one foot (0m3), lies midway between the south-western end of the first-mentioned shoal and the coastal mud flat.

Bhadreswar temple, situated about 14½ miles north-eastward of Navinar Point lighthouse, has a small white dome elevated 73 feet (22m3); there is a fort close westward of it.

Another temple, which is conspicuous, 77 feet (23m5) high and has a dome, stands about 8 cables north-north-eastward of Bhadreswar temple.

A conspicuous clump of banyan trees, 70 feet (21m3) high, stands about 3½ miles east-north-eastward of Bhadreswar temple.

Beacon "G", a black structure surmounted by a rectangle, 40 feet (12m2) in height, stands on the coast about 3 miles east-south-eastward of the banyan trees.

Beacon "I", a black structure surmounted by a ball, 60 feet (18m3) in height, also stands on the coast about 3 miles eastward of beacon "G".

Tekra lighthouse, described on page 320, is situated about 2¾ miles eastward of beacon "I".

Tidal streams.—The tidal streams set in an easterly direction along the coast, on the northern side of the gulf, with the flood tide, and in a westerly direction with the ebb, attaining a rate of from 2 to 3 knots.

Anchorages.—Directions.—Behind Mudwah point (*Lat. 22° 46′ N., Long. 69° 29′ E.*) a small vessel with local knowledge can obtain good shelter during the south-west monsoon; there is a depth of about 12 feet (3m7) over the bar at high-water springs.

Eastward of Navinar point there is shelter for a small vessel during

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Chart 43.

westerly winds in depths of from 2 to 3 fathoms (3m7 to 5m5), and out of the influence of the tidal streams, with the lighthouse bearing 249°. Care must be taken, however, when approaching this anchorage, to avoid the shoal bank, with depths of from one foot to 3 fathoms (0m3 to 5m5), lying from 1½ to 2¾ miles eastward of the lighthouse.

Vessels embarking salt from Mundra New port should anchor about one mile south-eastward of Navinar lighthouse in a depth of 8 to 10 fathoms (14m6 to 18m3), sand. This anchorage should only be approached from between south-south-westward and south-south-eastward owing to the shoals in the vicinity.

Charts 43, 39.

HEAD OF GULF.—Little Rann.—Tidal streams.—In the north-east monsoon, from November to February, the Little Rann eastward of Jangi, 15 miles up Hansthal creek, which flows into the head of the Gulf of Kutch, is dry; in the south-west monsoon the sea is driven by the wind many miles eastward, and the Little Rann is then a great inland sea and quite impassable.

This vast sheet of water is drained by three large creeks, viz., Nakti creek, Kandla creek, which flows into the gulf about 5 miles eastward of the entrance to Nakti creek, and Hansthal creek. These creeks are subject to regular tides; the ebb stream in Hansthal creek, owing to the large shallow area which covers and uncovers, attains a rate of from 6 to 7 knots at its mouth and flows longer than the flood stream, their durations being about 8 and 4 hours, respectively.

Between the mouth of Hansthal creek and the Saurashtra coast (page 9) on the southern side of the head of the gulf there is another Rann resembling the Little Rann; its western edge is fringed with mangrove bushes, and the ordinary high-water mark extends from the mouth of Hansthal creek towards Jodiya fort (*Lat. 22° 42′ N., Long. 70° 18′ E.*) (page 314). At high water this area is like a large inland sea of only a few feet depth, and in the south-west monsoon it is navigated by boats of from 3 to 4 feet (0m9 to 1m2) draught.

Chart 43.

About 4½ miles north-north-eastward of Jodiya fort lies the rocky islet of Borakathal, on the Rann, about one mile within the ordinary high-water mark; it is covered with bushes.

Caution.—The head of the Gulf of Kutch between Jodiya fort and the entrances to Kandla and Hansthal creeks is encumbered with shoals which change frequently; local knowledge is necessary for navigating this part of the gulf.

Chart 1318.

Pilots.—Pilots for Kandla and Hansthal creeks can be obtained off Outer Tuna light-buoy (page 321) throughout the year.

Tidal streams.—In the western approach to Kandla and Hansthal creeks the tidal streams in general are extremely irregular, and appear to be greatly influenced by a strong wind from any quarter. They are strong and gradually increase in velocity from Outer Tuna light-buoy to within the entrance to Hansthal creek; at the light-buoy they have a rate of 2½ knots at springs and 1½ knots at neaps, and at the entrance to Hansthal creek the rate is 7 knots at springs and 4 knots at neaps.

The maximum rate of the flood stream in Kandla creek at springs

Charts 826, 748b.

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Chart 1318.

is 3 to 4 knots. On Kandla bar the flood stream sets north-eastward at a rate of 2 to 3 knots at springs.

Nakti creek.—Beacons.—Lights.—Nakti creek has almost entirely silted up and can now only be used at high water by small native craft proceeding to Tuna bandar, situated on the western bank about 3 miles from the entrance. There is a fort near Tuna bandar.

In 1960, four pairs of leading beacons were being established to mark the channel to Tuna bandar.

The western entrance point of the creek is very low and covered with mangrove bushes which are nearly submerged at high water.

Narrow ridges of coarse sand and shell, from one to 6 feet (0^{m}3 to 1^{m}8) in height, front the Rann on the western side of Nakti creek.

Tekra islet, on the western side of the creek about 1¼ miles west-north-westward of the western entrance point, is a mud islet covered with mangroves. Another small islet similar in shape and composition is situated about half a mile south-eastward of Tekra islet.

A light (*Lat. 22° 56′ N., Long. 70° 07′ E.*) is exhibited, at an elevation of 46 feet (14^{m}0), from an iron column on a black masonry tower with white bands, 47 feet (14^{m}3) in height, situated on a sandy ridge which lies at the southern edge of the mangrove swamp on the western side of the entrance to Nakti creek; the lighthouse is about 1¼ miles south-westward of the western entrance point of the creek. This light is known as Tekra light.

A beacon with a T-shaped topmark, 30 feet (9^{m}1) in height, stands on a wreck about 1½ miles north-eastward of Tekra lighthouse.

Chart 39.

A light, for the use of aircraft, is occasionally exhibited, at an elevation of 129 feet (39^{m}3), from the airfield control tower, 92 feet (28^{m}0) in height, about 12 miles northward of Tekra lighthouse; the position of this light is only approximately charted, and it should not be used for navigation.

Chart 1318.

Kandla creek.—Kandla creek, the entrance to which lies amongst mangrove bushes about 6¾ miles east-north-eastward of Tekra lighthouse, extends northward between Khengarji bet and Sathsaida bet, both of which are typical Rann ground of hard mud flats, for about 7 miles where, near Jāfarwāli bandar, the creek forks; both sides of the creek are protected by steep mangrove-lined banks which just cover at high water springs.

The newly constructed port of Kandla stands on the western bank of the creek about 2 miles from the entrance. In 1960, the port was still being developed.

Port limits.—The western limit of the port of Kandla is the meridian of Long. 70° 00′ E.; the southern limit is a line joining position latitude 22° 46′ 30″ N., longitude 70° 00′ E. and beacon "D" (page 325).

Aspect.—Dangers.—Beacons.—Light-buoy.—Khengarji bet, the large island separating Kandla and Nakti creeks, is partially submerged at high-water springs and in places at high-water neaps; although there are a few small narrow ridges of sand near its southern end, from seaward, Khengarji bet appears to be covered with mangroves. The island is intersected by numerous small creeks, along the banks of which grow mangrove bushes; Khori creek forms the north-eastern side of the island.

Charts 43, 826, 748b.

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Chart 1318.

The coastal bank off the southern side of Khengarji bet dries to about one mile offshore and extends, with depths of less than 3 fathoms (5m5), to between 1¼ and 2 miles offshore.

Beacon "H", a black structure surmounted by a diamond, 40 feet (12m2) in height, stands on Khengarji bet about 2¾ miles north-eastward of Tekra lighthouse. Beacon "A", similar in construction but surmounted by a cone and 60 feet (18m3) in height, is situated near the south-eastern extremity of the island, about three-quarters of a mile west-north-westward of the western entrance point of Kandla creek.

Sathsaida bet, on the eastern side of the entrance to Kandla creek, is similar to Khengarji bet except that its southern side is fronted by narrow ridges of coarse sand and broken shell, about one to 2 feet (0m3 to 0m6) high.

Flamingo flat of drying mud extends up to about 1¾ miles off the south-western side of Sathsaida bet.

Beacon "B" (*Lat. 22° 59′ N., Long. 70° 15′ E.*), a black structure surmounted by a ball, 40 feet (12m2) in height, stands on Sathsaida bet about 1¾ miles east-north-eastward of beacon "A". Beacons "C" and "E" are also situated on Sathsaida bet about 1¾ and 3¼ miles, respectively, south-eastward of beacon "B"; they are similar to beacon "B" except they are surmounted by an inverted cone and a rectangle, respectively, and beacon "E" is 30 feet (9m1) in height.

Kandla bar, which dries in patches, lies in the entrance to Kandla creek between the coastal bank off Khengarji bet and Flamingo flat.

Kala Dara shoal, which dries 10 feet (3m0), extends about 8½ miles south-westward from the south-western extremity of Flamingo flat; it consists of hard fine sand.

Outer Tuna red can light-buoy, exhibiting a *white group flashing* light having *three flashes every fifteen seconds*, is moored about three-quarters of a mile off the south-western extremity of Kala Dara shoal and about 5 miles southward of Tekra lighthouse.

Channel.—Caution.—Buoyage.—In 1960, the approach channel to Kandla creek lay on the north-western side of Kala Dara shoal; it is marked by light-buoys, which are, however, liable to be shifted due to the frequent and sporadic changes in the depths. The channel had a least depth of 20 feet (6m1) as far as a position about 3 miles south-eastward of Tekra lighthouse, and there was a depth of 11 feet (3m4) over Kandla bar. Vessels of up to 25 feet (7m6) draught could navigate the channel at high water.

Chart 1318, with plan of Kandla creek.

Within Kandla bar the depths in the creek are very irregular and liable to change; in the fairway there are charted depths of from 3¼ to 10 fathoms (5m9 to 18m3) to within three-quarters of a mile of the fork, about 7 miles from the entrance.

Mariners are however warned that the course, depths and buoyage of the approach channel, together with the depths in Kandla creek, are subject to constant change and the latest information should be obtained from the Deputy Conservator at Port Kandla (*Lat. 22° 58′ N., Long. 70° 13′ E.*) before entering.

The nature of the bottom throughout the creek is coarse sand, small stones and broken shell, except where there are depths of less than 3 fathoms (5m5) near the banks; there the bottom is mud.

Charts 43, 39, 826, 748b.

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Chart 1318, plan of Kandla creek.

Barry shoal, a ridge with a least depth of 9 feet (2m7) situated on the western side of the creek with its southern end about 3½ miles northward of the entrance to the creek, extends northward for nearly one mile to a position about 1½ cables south-eastward of Kandla old oiling pier.

A red conical buoy is moored on the eastern side of the shoal near its northern end.

Pilotage.—Pilotage is compulsory for merchant vessels from Outer Tuna light-buoy.

Requests for pilots should be made through Kandla radio or by arrangement with the Harbour Master at Port Kandla.

Towers.—Signal station.—Signals.—A black masonry radar tower, 95 feet (29m0) high, is situated about 1¼ miles southward of the root of the old oiling pier at Kandla; two frame work water towers, each 84 feet (25m6) high, stand about 6 cables west-north-westward and 1½ miles northward, respectively, of the radar tower.

The port signal station is situated near the radar tower; communication is by semaphore or the International Code of Signals by day or Morse code at night.

Signals in use in the port of Kandla are given in the Kandla Port Rules issued by the port administration.

A black ball displayed at the masthead of the port signal station indicates that a vessel is about to enter or leave the harbour.

In the event of an outbreak of fire in the port area or aboard a vessel lying alongside, a blue square flag by day or *two green* lights, vertically disposed, at night, will be displayed from the yardarm of the port signal station; in addition *eight short* blasts followed by *one long* blast will be sounded and repeated at short intervals.

Berths.—Mooring buoys.—Anchorage.—On the western side of Kandla creek, about 2 miles from the entrance, lies the newly constructed port of Kandla (*Lat. 22° 58′ N., Long. 70° 13′ E.*), where there is a quay for working general cargo and a tidal basin for the use of lighters and sailing vessels.

The quay is 2,700 feet (823m0) in length and has a designed depth alongside of 32 feet (9m8); it can accommodate four vessels of up to 600 feet (182m9) in length in berths Q1 to Q4. In 1960, work was in progress to extend this quay by another 2,025 feet (617m2); this work was due for completion in 1961.

The quay is equipped with electric cranes, with capacities of up to 10 tons, and has ample storage and transit sheds.

The tidal basin lies about three-quarters of a mile northward of the quay; it is equipped with cranes.

Three moorings, M1 to M3, are situated in the stream abreast the new port; they can accommodate vessels working general cargo with draughts of from 25 to 29 feet (7m6 to 8m8).

The old oiling pier lies about one mile northward of the tidal basin; it is 306 feet (93m3) in length and has a depth of 30 feet (9m1) alongside.

There is also a new pier, with a depth of 30 feet (9m1) alongside, which can accommodate tankers of up to 18,000 tons. Both piers are connected by pipelines to the storage tanks about 6½ miles westward. The old pier is equipped with a 6-ton travelling crane.

A small wooden ferry jetty, with a depth of 13 feet (4m0) alongside its floating pontoon, is situated south-westward of the old oiling pier;

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Chart 1318, plan of Kandla creek.

another small wooden jetty, for the use of lighters, is situated at the salt works about one mile northward of the pier. There is a mooring buoy about 3½ cables south-eastward of this latter jetty, for vessels not exceeding 500 feet (152m4) in length, 28 to 29 feet (8m5 to 8m8) draught or 10,000 tons.

There is good anchorage, in a depth of 4½ fathoms (8m2), coarse sand, small stones and broken shell, about 3½ cables north-eastward of the old oiling pier.

Quarantine.—Quarantine anchorage.—Vessels liable to quarantine regulations will remain in the quarantine anchorage, about one mile southward of Outer Tuna light-buoy (page 321), until pratique is granted; those suspected of minor infectious diseases may be brought into the harbour and anchored or berthed in a suitable place.

Prohibited fishing.—Fishing is prohibited in Kandla creek southward of latitude 23° 04′ 30″ N.

Chart 1318.

It is also prohibited in the approaches to Kandla creek within an area defined by a line joining the western entrance point of Kandla creek, position Lat. 22° 51′ N., Long. 70° 00′ E., position Lat. 22° 46′ 30″ N., Long 70° 00′ E., position Lat. 22° 55′ N., Long. 70° 17″ 14′ E. and the eastern entrance point of the creek.

Tidal streams.—*See* page 319.

Directions.—A vessel approaching from south-westward or westward should make for a position with Tekra lighthouse bearing 011°, distant about 5¾ miles, to embark a pilot. No further directions are given as pilotage is compulsory from this position and the channel and buoyage are constantly changing.

Vessels awaiting the tide should anchor about one mile south-westward of Outer Tuna light-buoy (*Lat. 22° 51′ N., Long. 70° 07′ E.*) in a depth of about 6 fathoms (11m0), mud.

It takes about 1½ hours to reach Kandla and it is advisable to leave the above positions just after half flood when there would be a depth of about 5 fathoms (9m1) in the approach channel.

Chart 1318, plan of Kandla creek.

Port facilities.—Fresh provisions are available. Water is laid on to the quay and oiling piers, and can be supplied by waterboat to vessels in the stream.

Large stocks of fuel and diesel oils are maintained.

A large fleet of barges and tugs, both for berthing and towing, are available.

There are four 6-ton, sixteen 3-ton and one 10-ton electric travelling cranes in the port.

Repairs to hull, boilers and machinery can be carried out and there is a floating dock; for details of the latter *see* Appendix I on page 343.

There is a harbour radar station at the customs office, and the port is equipped with VHF radio telecommunication facilities for contact with the pilots.

Shallow water divers are available.

There is a dispensary at Old Kandla, and seamen can be admitted to Jubilee hospital at Bhuj, about 32 miles north-westward.

Deratisation.—*See* page 29.

Town.—Communications.—The township of Kandla and Gandhidham had, in 1959, a population of about 39,000. Gandhidham,

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Chart 1318, plan of Kandla creek.

about 7 miles from Kandla, is connected with the latter by road and rail.

A metre gauge railway system, which serves the alongside berths at Kandla, connects the port with its hinterland.

There is regular communication by sea with Bombay and Cochin, and a daily ferry service with Port Navlakhi in Hansthal creek.

There is a regular air service between Bhuj and Bombay. In 1960, a new airport was under construction at Kandla.

Kandla is connected with the general telephone and telegraph systems.

In 1960, Kandla was being connected with the Saurashtra area and Ahmedabad by a national highway, which was expected to be completed in 1962.

Storm signals.—Storm signals are displayed at Kandla; the general system is used. *See* page 20.

Radio.—There is a radio station at Kandla. *See* page 24.

Trade.—Shipping.—The principal exports are iron ore, zinc concentration, bones, cotton, salt and general merchandise; the chief imports are food grains, iron, steel, petroleum and oil.

In 1959, 146 vessels with a total net tonnage of 860,669 entered the port.

Charts 1318, 39.

Hansthal creek.—Hansthal creek (*Lat. 22° 56′ N., Long. 70° 23′ E.*) is the largest of the three salt-water creeks, which penetrate into the Little Rann at the head of the Gulf of Kutch. Its width has doubled by erosion in the last 50 years and it is now about 1½ miles wide at the entrance, which lies between Sathsaida bet, northward, and the Saurashtra coast, southward, about 8 miles east-south-eastward of the entrance to Kandla creek.

The creek has a north-easterly direction for about 4 miles, at which point Halai kāri branches off in an easterly direction and Cutchi kāri runs northward along the eastern side of Sathsaida bet; about 8 miles from the entrance a large expanse of level ground is flooded at high water.

Halai kāri at its junction with Hansthal creek is known as Sui creek; it is navigable by vessels of 9 feet (2^{m}7) draught for about 4 miles but further eastward it becomes a ditch.

Between Sui creek and Warsāmedi creek, which flows into Hansthal creek close northward, lies the island of Navlakhi bet, upon which stands the newly constructed port of Navlakhi.

Above Navlakhi bet, Hansthal creek is navigable by moderate-sized boats for 6 or 7 miles, but as the mangroves cease after 2 or 3 miles there is only the ripple of the water in the deeper channel to point out the fairway.

Murga bet, about three-quarters of a mile north-westward of Navlakhi bet, lies in the middle of Hansthal creek and consists of several islets covered with mangroves.

Chart 1318.

Dangers.—Beacons.—Buoyage.—Light.—Sathsaida bet and Flamingo flat, off the southern side of that island, are described on page 321. The northern side of Sathsaida bet is intersected by numerous small creeks.

Beacon "F", a black structure surmounted by a ball, 40 feet (12^{m}2)

Charts 826, 748b.

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Chart 1318.

in height, stands near the south-eastern extremity of Sathsaida bet. Beacon "D", situated on the coast about 2¾ miles westward of Beacon "F", is similar to the latter but surmounted by a diamond.

Singari shoal, with depths of less than 3 fathoms (5^{m}5), extends up to about 1½ miles off the southern side of Flamingo flat; it has a least depth of 8 feet (2^{m}4) on its southern edge.

Kapoor shoal, with depths of less than 3 fathoms (5^{m}5) and a least depth of 4 feet (1^{m}2), extends about 5½ miles south-westward from the western end of Singari shoal and roughly parallel with Kala Dara shoal (page 321); it consists of ridges and pinnacles of coarse sand, small stones and broken shells.

The southern side of the approach to Hansthal creek is formed by the Saurashtra coast, which is fringed with ridges of coarse sand and broken shell, one to 3 feet (0^{m}3 to 0^{n}9) high.

The coastal bank off the Saurashtra coast dries in places and has depths of less than 3 fathoms (5^{n}5); it extends about 3 cables offshore at the southern entrance point to Hansthal creek but up to about 3 miles offshore between that point and Mungra reef (page 314), about 10½ miles south-westward.

Baptista shoals, which dry 4 feet (1^{m}2) in patches and are similar in composition to Kapoor shoal, extend for about 5½ miles in a south-westerly direction from a position on the coastal bank about 4 miles west-south-westward of the southern entrance point to Hansthal creek; a ridge, with depths of 3 fathoms (5^{n}5) and less, extends north-eastward from the south-western end of Baptista shoals to Kapoor shoal.

The approach channel to Hansthal creek lies between Kapoor and Singari shoals, northward, and Baptista shoals, southward. The bar at the entrance has a least depth of 12 feet (3^{m}7) but *see* caution on page 319.

The channel is marked on the northern side by Nos. 2 and 4 red spherical buoys, each surmounted by a T-shaped topmark, which are moored on the southern edge of Singari shoal; on the western side by No. 6 red barrel buoy moored about 1½ miles north-eastward of beacon "F"; and on the southern side by Nos. 3 and 5 black conical buoys, each surmounted by a triangular topmark, which are moored off the northern edge of Baptista shoals and the coastal bank, respectively, about 4 miles west-south-westward and three-quarters of a mile north-eastward of the southern entrance point to Hansthal creek.

A wooden beacon, surmounted by a triangular topmark and 10 feet (3^{n}0) in height, stands on the south-western extremity of Murga bet.

A light is exhibited, at an elevation of 104 feet (31^{m}7), from a conspicuous steel framework tower, 100 feet (30^{m}5), in height, situated on the north-western extremity of Navlakhi bet (*Lat. 22° 57′ N., Long. 70° 27′ E.*).

Anchorages.—The holding ground in Hansthal creek is generally speaking bad, as rock exists a little way beneath the mud and the strong tidal streams cause a vessel to drag easily.

A vessel over 2,000 tons should anchor about three-quarters of a mile north-westward of the entrance of Moti Pātar creek, which is on the south-eastern side of Hansthal creek, about 3¾ miles within the entrance, in depths of 5 fathoms (9^{n}1); the holding ground here is fairly good, and the directions of the tidal streams are comparatively steady.

A small vessel may anchor farther northward as the depths are

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Chart 1318.

sufficient, but cross currents from Sui and Warsāmedi creeks cause excessive yawing, thus bringing a great strain on the cable.

Tidal streams.—*See* page 319.

The flood and ebb streams in Hansthal creek attain a rate of 5 knots in the channel between the mangrove bushes, where it is from one to 1½ miles wide; during occasional freshets this rate may sometimes increase to 7 knots.

Directions.—A vessel bound for Hansthal creek should close Outer Tuna light-buoy to embark a pilot as described on page 319. No further directions are given as local knowledge is necessary for navigating Hansthal creek and its approaches.

Caution.—Ships' boats or similar small craft should on no account anchor in Hansthal creek without local knowledge, as freshets which occasionally occur cause a boat to drag under; small steam craft have been sunk from this cause. The tidal streams vary greatly both in rate and direction in Hansthal creek, but in the above-mentioned anchorages a vessel may lie with safety.

Port Navlakhi.—Communications.—Port Navlakhi comprises the railway station and the various buildings in connection with the port. In 1960, it had a population of about 2,500.

There is a daily ferry service to Kandla and regular communication by sea with Bombay, Rangoon and Europe. It is connected with the railway, telegraph and telephone systems.

Port facilities.—There are ten wooden jetties, with depths of from 4 to 9 feet (1^{m}2 to 2^{m}7) alongside, in Sui creek, and a steel wharf, which dries about 4 feet (1^{m}2), in Warsāmedi creek. There are seven cranes of from 3 to 12 tons capacity; the 12-ton crane is conspicuous from westward.

Lighters are obtainable, and there are three tugs.

There is a hospital at Morvi, about 30 miles eastward of Port Navlakhi; it has accommodation for seamen.

Limited quantities of water, provisions and vegetables are obtainable. There are no facilities for supplying fuels.

Small repairs can be carried out.

Storm signals.—Storm signals are displayed at Port Navlakhi; the general system is used. *See* page 20.

Trade.—Shipping.—The principal exports are cotton, salt, seeds, manufactured goods, iron and steel; the main imports are food grains, cotton seeds, coral, kerosene and chemicals.

In 1958-59, 14 powered vessels and 284 sailing vessels with total net registered tonnages of 48,806 and 25,737, respectively, used the port.

Chart 39.

COAST.—Aspect.—Dangers.—From Āsār Māta (*Lat. 22° 51′ N., Long. 69° 13′ E.*), the northern entrance point of the Gulf of Kutch, the coast of Kutch district trends north-westward for about 76 miles to Sir mouth of the Indus delta; the north-western bank of Sir river forms the south-eastern boundary of West Pakistan.

For the first 43 miles to the entrance to Godia creek the coast is uniformly low and fronted by a narrow sandy ridge, which is about 30 feet (9^{m}1) high except near Āsār Māta where it is slightly higher. Several small rivers flow into the sea on this stretch of coast, on which

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Chart 39.

there are numerous villages surrounded by well cultivated land except about 28 miles north-westward of Āsār Māta, where there is an extensive swampy area.

The 6-fathom (11m0) line lies about 2½ miles offshore between Āsār Māta and a point about 22 miles north-westward and from about 4 to 6½ miles offshore from thence to the entrance to Godia creek. Outside this there are no known dangers, except for Lushington shoal described on page 297, but *see* caution on that page.

Between the entrance to Godia creek and Sir mouth the coast is low and much indented with creeks, the largest being Khori creek. The mouths of these creeks are shallow and can only be used by boats; they are fronted by the coastal bank, with depths of less than 3 fathoms (5m5), which extends as far as 9 miles offshore in places.

Chart 43.

Coast.—Dangers.—Light.—Detached patches, with depths of 39 and 34 feet (11m9 and 10m4), lie about 5¾ miles south-westward and westward, respectively, of Āsār Māta. The dangers southward and eastward of Āsār Māta are described on page 315.

Dholo Pir temple, 33 feet (10m1) high and prominent, is situated on the coast about 10 miles north-westward of Āsār Māta.

Chachhi light is exhibited, at an elevation of 45 feet (13m7), from a framework tower on a masonry hut, 21 feet (6m4) in height, situated on the coast about 4¼ miles north-westward of Dholo Pir temple. A conspicuous tower, 106 feet (32m3) high, stands about 6 cables eastward of this light-structure.

A 17-foot (5m2) patch lies about 10 miles west-north-westward of Chachhi light-structure and 1¾ miles offshore.

Charts 43, 39.

Anchorages.—I. N. S. *Investigator* reported in 1958 that anchorages with good holding ground, generally mud, could be obtained in depths of 6 to 7 fathoms (11m0 to 12m8) about 4 to 5 miles off the coast between Āsār Māta and Godia creek.

Chart 39.

Godia creek.—Port Jakhau.—Beacons.—Light.—The entrance to Godia creek, known locally as Port Jakhau (*Lat. 23° 14′ N., Long. 68° 35′ E.*), can be identified by some sand hills, 30 feet (9m1) high, on the northern side of its entrance, upon which are two wooden beacons, about 3 cables apart; the northern beacon is surmounted by a St. Andrew's cross and the southern by a rectangular cage.

The southern entrance point is the northern extremity of a narrow sand spit which extends south-eastward from the entrance for about 11 miles where it joins the coast forming a narrow and shallow inlet between it and the coast eastward; a beacon, surmounted by a triangle point up, stands on the northern end of this spit and a similar beacon stands about one mile south-south-eastward of it; a third beacon, surmounted by a diamond, stands about 2½ miles south-eastward of the second.

About 1¾ miles within the entrance points, on the southern side of the creek, there is an iron wharf.

A light is exhibited, at an elevation of 47 feet (14m3), from a framework tower on a masonry hut, 22 feet (6m7) in height, situated on the above wharf.

During the north-east monsoon, from September to March, vessels

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Chart 39.

load salt and salt products; medium draught vessels anchor outside the entrance to the creek about 4½ miles south-westward of the southern beacon on the northern side of the entrance.

Owing to the nature of the coast little is visible until the vessel is near the 6-fathom (11m0) line and at night, or in thick weather by day, she should not proceed farther until sure of her position.

The beacons on the sand spit southward of the entrance to the creek are useful to a vessel approaching from southward; those on the northern side of the entrance are useful for anchoring; local knowledge is necessary for entering the creek.

Charts 118, 39.

Khori creek.—Khori (Kori) creek, one of the outlets of the Little Rann at the head of the Gulf of Kutch, was once one of the mouths of Indus river. The entrance, which lies about 19 miles north-westward of the entrance to Godia creek, is fronted by a shallow bar, but the creek can be navigated by native craft as far as Lakhpat, about 28 miles within the entrance on the southern bank.

When a vessel is in depths of more than 3 fathoms (5m5) off the mouth of Khori creek, the low land is not seen from the deck, except in the clearest weather when the low hills north-eastward will be visible The most prominent of these is Maniāra hill (*Lat. 23° 29′ N., Long. 68° 37′ E.*) 220 feet (67m1) high, on the summit of which stands a fort, situated about 37 miles north-westward of Chachhi light-structure.

Chart 118.

Khori creek is 5 to 6 miles wide at its entrance between Makra and Saleh beacons; it is blocked by several sandbanks, except on the eastern side, where a deep-water channel leads into the creek.

The bar, whose outer edge is over 10 miles to seaward of the eastern entrance point, is 4 miles across with depths of from 10 to 12 feet (3m0 to 3m7). Within the bar a channel, one to 3 miles wide and with depths of from 3 to 12 fathoms (5m5 to 21m9), leads through the creek for a distance of 10 to 12 miles; close westward of Ghosh beacon the width of the channel is reduced to one mile by sandbanks. Northward of Sugar creek the channel is divided into Eastern and Western channels by Middle sandbank.

The creek is from 3 to 4 miles wide for a distance of 30 to 40 miles; its banks are only 2 to 5 feet (0m6 to 1m5) high, and are intersected by creeks; between Saleh and Usman beacons the eastern bank is steep-to. As the channel and banks are liable to constant changes local knowledge is necessary for entering the creek.

Tidal streams.—The tidal streams are strong in the estuary of Khori creek (*Lat. 23° 30′ N., Long. 68° 20′ E.*), attaining a rate of 5 knots at springs and of about 3 knots at neaps; the flood stream sets up the channel of the creek until three-quarters flood, when it sweeps over the sandbanks in the entrance.

Chart 39.

Off lying bank.—Caution.—Khori (Kori) Great bank is described on page 332.

See caution on page 297.

Charts 118, 41.

INDUS DELTA.—General remarks.—Aspect.—From the south-eastern boundary of West Pakistan, which is the north-western bank

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Charts 118, 41.

of Sir river, the entrance to which lies about 11 miles westward of the entrance to Khori creek, the coast trends in a north-westerly direction for about 100 miles to Karāchi forming the delta of Indus river; it is low and flat throughout, and partially flooded at high water to a considerable distance inland. With the exception of a little jungle, it is destitute of trees or shrubs, and nothing is seen for many miles but swamp; the land is scarcely discernible at more than 2 miles offshore, except where bushes exist; these can be seen at low water from a distance of from 5 or 6 miles.

On a coast so devoid of features, and at times partly submerged, it is difficult to distinguish the different mouths of Indus river; a number of beacons, erected many years ago for this purpose, have long since collapsed or disappeared owing to the constantly changing coast-line.

It is dangerous for a vessel of deep draught to approach the Indus delta as the breakers on the shelving coastal banks, which extend many miles offshore, are often seen before the coast is sighted; this is particularly the case during the south-west monsoon when visibility is poor and the sea breaks in depths of 3 fathoms (5^{m}5) or more. The discoloration of the water is very marked, especially off the main freshwater mouths on the ebb tidal stream, when during spring tides it extends more than 10 miles offshore.

A narrow belt of low sandhills generally forms the sea-face, fronted by drying sandbanks and backed by mangrove swamps interspersed by mud-banked tidal creeks. During the heat of the day, and specially during the dry season when the wind blows off the land, a heavy dust-haze hangs low over the coast making the coastal features unrecognisable even from a short distance to seaward.

In the vicinity of Karāchi the land is higher, and westward of that place, the high range of mountains, terminating in Cape Monze (*Lat. 24° 50′ N., Long. 66° 40′ E.*) about 19 miles westward of Karāchi, unmistakably indentifies the north-western extremity of the Indus delta.

The delta of Indus river covers an area of 3,000 square miles; it is almost perfectly level and overgrown with tamarisk and mangrove. There is good pasturage in the marshes, and rice flourishes in places; in some parts there are immense deposits of salt.

By gradual but frequent alterations in the courses of the distributaries of Indus river, the various mouths are constantly changing and advancing seaward, altering the contours of the coastal banks and fathom lines; consequently only very brief descriptions of the mouths will be given.

The swamps of the Indus delta have less obnoxious reptiles and quadrupeds than most large deltas, and, beyond some jackals and hyenas, few exist. In the cold season myriads of ducks, geese and other water-fowl are seen in the neighbourhood of the freshwater mouths.

The salt-water worm (*Teredo Navalis*) is destructive, to a most extraordinary degree, to the bottom of boats and timber. In the short space of six weeks it has been found that they can penetrate teak plank fully half an inch thick. So well aware of this are the fishermen that they lay their boats aground every ten days for the purpose of coating their bottoms with fish oil, which is considered by them a good protection.

Charts 39, 826, 748b.

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Charts 118, 41.

The climate is cool in winter, hot in summer and unhealthy during the floods.

Caution.—Local knowledge is essential for coastwise navigation and entry into any creek. Mariners passing along the coast should not approach within the 10-fathom (18m3) line; coastal contours shoal steeply in places, more especially in the vicinity of The Swatch (page 332).

It was found, in 1952, that the whole Indus delta coastline, coastal flats and fathom lines had extended to seaward as much as 5 miles in places in the last fifty years, notably between Sir and Turshian mouths. Mariners should exercise great caution when navigating on charts from old surveys.

Chart 118.

Coast.—Dangers.—Beacon.—The entrance to Sir mouth, the south-eastern entrance point (*Lat. 23° 37′ N., Long. 68° 08′ E.*) of which lies about 11 miles westward of the north-western entrance point of Khori creek, is flanked by shallow spits which dry in places and extend from 4 to 6 miles offshore.

The bar, over which there is a depth of 12 feet (3m7), is situated between the points of these spits. The channel, with a width of about one mile, runs along the left bank with a depth of from 4 to 7 fathoms (7m3 to 12m8).

Sir river is navigable by small craft for some distance from the bar.

The south-eastern entrance point of Bhitiāro (Bhityaro) creek lies about 7 miles west-north-westward of the north-western entrance point of Sir mouth.

The western entrance point to Wāri creek, the principal eastern mouth of Indus river, lies about 10 miles westward of the north-western entrance point to Bhitiāro creek; the point, which has extended some 5 miles southward in the last fifty years, is bordered by low, narrow sandy ridges which cover at high water spring tides, and is backed for miles by mangrove swamp. From the mouth of the creek, which is about 2 miles wide, shallow flats, with depths of less than 6 feet (1m8), extend about 5 miles to seaward. The tidal streams set strongly over these flats into and out of the creeks. The whole of the coast between the entrance to Wāri creek and the mouth of Khobar creek, about 25 miles north-westward, has extended about 5 miles to seaward in the last fifty years; it consists of low sandy ridges, with mangrove swamp behind them through which several Indus distributaries find their way to the sea.

Bachiar creek (Baghiar mouth), about 7½ miles westward of Wāri creek, can only be entered by small craft at high water.

Chart 41.

Kahr creek, about 7 miles westward of Bachiar creek, is nearly 2 miles wide at its entrance which is encumbered with sand bars; small craft with local knowledge can enter at all states of the tide.

From Kahr creek the coast trends about 8 miles north-westward to the entrance to Qalandri or Sunri creek, which, though the principal freshwater outlet of Indus river, can only be entered at high water; from its mouth drying mud flats extend about 5 miles to seaward, whence the bottom shelves comparatively steeply, a depth of 6 fathoms (11m0) being found one mile further seaward.

The mouth of Khobar creek, another major mouth of Indus river,

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Chart 41.

lies about 7 miles north-westward of Qalandri creek; it has large drying mud flats across its mouth.

Khobar beacon (*Lat. 23° 59′ N., Long. 67° 27′ E.*) the only beacon remaining of the many that once marked some of the main Indus mouths, is situated on a large sand dune on the southern side of Khobar creek.

The mouth of Ghora Khan (Gora Chan) lies about midway between Qalandri and Khobar creeks.

From Khobar creek the coast trends north-north-westward about 5 miles to Turshian mouth; the coastal sand islands here are wider and attain elevations of as much as 10 feet (3^{m}0); their shapes vary from season to season, but they are always above water.

Turshian mouth, which can only be entered at high water, lies about 5 miles north-westward of Khobar creek, and, with the latter, is a major entrance for country craft proceeding to Keti bandar, the principal village in the delta. Keti harbour is situated on the eastern bank of Khobar creek about 7 miles within the entrance; it is connected with Karāchi by road and by telegraph.

The whole of this part of the coast, except the coastal sand dunes, is flooded at high water, and each year during the floods of Indus river great changes occur.

From Turshian mouth the coast trends north-north-westward about 17 miles to Dabbo creek, the next major mouth. The bar of this creek has a least depth of 9 feet (2^{m}7) in the channel across the flats to seaward of the mouth, and depths of from 7 to 8 fathoms (12^{m}8 to 14^{m}6) within the entrance. Strong tide rips occur in the entrance on the ebb tidal stream. Numerous small creeks discharge into the sea between Turshian mouth and Dabbo creek, none of which are navigable except by country craft at high water.

Paitiani creek, about 4 miles northward of Dabbo creek, is navigable at all states of the tide in fine weather. Between Dabbo and Paitiani creeks the sandhills are higher, attaining an elevation of 15 feet (4^{m}6). The entrances to both creeks are well defined, shallow banks extending about 2 miles to seaward on either side of the entrance channels.

Charts 61, 41.

Khuddi creek, the entrance to which lies about 12 miles north-north-westward of the entrance to Paitiani creek, and Phitti creek (*Lat. 24° 40′ N., Long. 67° 09′ E.*), about 6 miles further north-north-westward, have a common entrance bar over which there is a least depth of 9 feet (2^{m}7). Within the bar, the approach channels, with depths of over 3 fathoms (5^{m}5), diverge east-south-eastward and north-westward, respectively, and the creeks become separated by a large sandy island, 12 feet (3^{m}7) high. Shallow flats extend about 3½ miles seaward from the entrances and the 3-fathom (5^{m}5) line lies about 5 miles offshore, with the 6-fathom (11^{m}0) line about three-quarters of a mile further to seaward. Vessels approaching Karāchi from southward should take care to avoid this locality.

Chart 61.

Ghizri and Korangi creeks, the northernmost draining the swamps of the delta, flow into the sea by a common mouth about 4½ miles north-north-westward of the northern entrance point to Phitti creek and 6½ miles south-eastward of Manora point the western entrance point to Karāchi harbour. The bar, on which there are two drying

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Chart 61.

sandbanks, lies about 2 miles to seaward of the entrance and has a depth of from 4 to 5 feet (1m2 to 1m5) in the channel. About 2½ miles within the entrance, at the base of a sandy bluff on the northern side of Korangi creek, there are some buildings and a jetty; northward of the bluff rises Ibrahim Haider hill, 92 feet (28m0) high, which is prominent from seaward in clear weather.

Chart 41.

The sand islands that form the coast between Dabbo and Ghizri creeks are much more stable than those further southward and are from 8 to 15 feet (2m4 to 4m6) high and several miles wide.

Chart 39.

Khori Great bank.—Khori (Kori) Great bank is an extension in a south-westerly direction of the coastal bank, with depths of from 11 to 18 fathoms (20m1 to 32m9), between the mouth of Khori creek and Bachiar creek up to a distance of 60 miles offshore; the bottom is fine grey sand. *See* caution on page 297.

The Swatch.—About 37 miles westward of the entrance to Sir river is the north-eastern extremity of a remarkable submarine valley named The Swatch, which extends in a south-south-westerly direction for about 52 miles, and is from about 3 to 8 miles wide, with depths of less than 100 fathoms (182m9) on either side of it; it is narrow and steep at its head, is almost regular in shape and has steep sides and a flat sloping bottom. The bottom slopes gradually from a depth of 100 fathoms (182m9) nears its head to over 600 fathoms (1,097m3), whence the edge of the continental shelf slopes steeply down to the floor of Arabian sea; the bottom and sides of The Swatch are of soft grey mud, with some sand and gravel on its north-western edge. The Swatch can be of considerable assistance to vessels equipped with echo sounding gear when approaching Karāchi from southward; an echo trace of a cross section showing the maximum depths obtained will provide a clear indication of the vessel's position, which is particularly useful during the south-west monsoon when visibility is poor and strong sets are experienced.

Chart 41.

Light-buoy.—*Sindhi* can light-buoy (*Lat. 23° 57′ N., Long. 67° 08′ E.*), painted red and exhibiting a *white group flashing* light having *three flashes every thirty seconds*, is moored about 15½ miles west-south-westward of Turshian mouth (page 331); the position of this light-buoy is approximate and it is withdrawn during the south-west monsoon, between the 15th of May and the 15th of October.

Chart 39.

Currents.—The currents off the Indus delta are of monsoonal origin and run predominantly parallel with the coast, north-westward in December and January and south-eastward for the rest of the year.

This current normally attains a rate of about one knot but from February until the end of the south-west monsoon rates up to about 2 knots may be expected.

In the close vicinity of Karāchi little current is experienced.

Charts 118, 41.

Tidal streams.—The flood stream sets north-eastward into the bay northward of Khori creek (*Lat. 23° 30′ N., Long. 68° 20′ E.*), and north-north-westward, parallel with the coast, northward of Turshian mouth; the ebb stream sets south-westward and southward.

Charts 826, 748b.

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Charts 118, 41.

The tidal streams are strong in the entrances to the principal mouths of Indus river; at the bar of Sir mouth they attain a rate of from 3 to 4 knots at springs; and at Keti bandar in Turshian creek the ebb stream attains a rate of 5 knots. Further northward, at the mouths of Dabbo and Phitti creeks, the ebb stream may attain a rate of 3 knots.

The ebb stream rushing out of the various delta mouths causes heavy tide rips, especially during spring tides, and carries large quantities of silt laden water many miles to seaward; the line of demarcation between the mud coloured river water and the clean sea water is very sharply marked at times.

Charts 40, 61.

APPROACHES TO KARĀCHI HARBOUR. — Aspect. — Dangers.—Lights.—Signal station.—The entrance to Karāchi harbour lies between the southern end of Manora breakwater (*Lat. 24° 47′ N., Long. 66° 59′ E.*), which extends about 2½ cables south-south-eastward from Manora point, and the southern extremity of Keamāri groyne, about 7 cables north-north-eastward.

On the eastern side of the entrance between the entrance to Ghizri and Korangi creeks and Manora point there is a shallow bay with a sandy beach. Clifton, the fast growing southern suburb of Karāchi, is situated on some low sandhills about 3 miles eastward of Manora point; it is distinguishable by several groups of large square buildings.

Keamāri beacon, a conspicuous framework structure surmounted by a cone stands at an elevation of 82 feet (25^{m}0) on the coast about 2¼ miles north-eastward of Manora point.

The coastal bank, with depths of less than 3 fathoms (5^{m}5), extends about 2½ miles offshore between the entrance to Ghizri and Korangi creeks and Clifton.

A red conical light-buoy, exhibiting a *white flashing* light *every second*, is moored off the edge of the coastal bank about 3¼ miles south-south-eastward of Manora point; the light-buoy marks the northern edge of a spoil ground; its position is only approximate and it is liable to be washed away or withdrawn frequently.

Oyster islands, consisting of Bara Andai, Baur island and Chota Andai, together with some rocks, lie on the coastal bank with the southern extremity of Bara Andai about one mile north-eastward of Manora point. Bara Andai attains an elevation of 93 feet (28^{m}3) and the northern rock of the group, about 5 cables northward of Bara Andai, is awash.

A light is exhibited, at an elevation of 108 feet (32^{m}9), from a white square building, 15 feet (4^{m}6) in height, situated about one cable northward of the southern extremity of Bara Andai.

Chart 40.

Manora point, the south-eastern extremity of a narrow hill, about 95 feet (29^{m}0) high, which forms the western side of the harbour entrance, is a perpendicular cliff. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 156 feet (47^{m}5), from a red steel circular tower with white bands, a black base and a white dome, 124 feet (37^{m}8) in height, situated on the hill about 3½ cables north-north-westward of Manora point.

A conspicuous white lattice tower, 141 feet (43^{m}0) high, and a

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Chart 40.

flagstaff stand about half a cable west-south-westward and south-westward, respectively, of Manora Point lighthouse (*Lat. 24° 48′ N., Long. 66° 59′ E.*).

The signal station for communicating with vessels outside the harbour is situated in the above tower; it is manned continuously and if a vessel appears to be standing into danger she will be warned by flashing the letter "U" in Morse code.

A light is exhibited, at an elevation of 50 feet (15m2), from the head of Manora breakwater.

Charts 40, 61.

Between Manora point and Buleji point, about 9 miles west-north-westward, the coast recedes forming Hawkes bay. For radar range *see* Appendix III on page 346.

A light is occasionally exhibited from the roof of one of the buildings of the radar school, about three-quarters of a mile west-north-westward of Manora Point lighthouse.

There are a number of large white buildings, a high tower and several flagstaffs near the coast between 1½ and 2 miles north-westward of Manora Point lighthouse.

A black framework tower, 70 feet (21m3) high and surmounted by a square radar reflector, stands on the coast about 3¼ miles north-westward of Manora Point lighthouse.

A light for the use of aircraft is exhibited from a position about 6¾ miles north-north-westward of Manora Point lighthouse.

Buleji point is low and sandy.

The coastal bank, with depths of less than 3 fathoms (5m5), extends about a quarter of a mile westward from Manora breakwater and the same distance offshore between Manora point and a position about 4 miles north-westward.

Dangey patches, some rocky heads with a least depth of 34 feet (10m4) over them, lie about 1½ miles south-westward of Manora Point lighthouse.

Chart 61.

Hawkes bay is a shallow bight between Buleji point and a point about 4 miles eastward; a rocky spit, with depths of 28 and 35 feet (8m5 and 10m5) near its outer end, extends about 2 miles south-westward from the eastern entrance point. A rock, with a depth of less than 6 feet (1m8) over it, lies in the middle of the entrance to the bay which is mostly occupied by depths of less than 3 fathoms (5m5).

Foul ground and shoal water, with depths of less than 5 fathoms (9m1), extend about 1¾ miles south-eastward and south-south-eastward from Buleji point. Four detached shoals, with depths of from 30 to 34 feet (9m1 to 10m4), lie about 2½ miles southward and south-eastward of the point as indicated on the chart.

From Buleji point the coast trends about 8½ miles westward to Cape Monze; it is rocky and backed by the Jhil range of hills. These hills, which are an offshoot of the Kirthar range, have a nearly level crest with some remarkable hummocks on it, the highest being Miān Mirza Bor, which rises to an elevation of 766 feet (233m5) about 3 miles north-eastward of Cape Monze.

Cape Monze, or Rās Muāri, is a bluff sloping headland forming the south-western termination of the Jhil range; about three-quarters of a mile eastward of the western extremity of Cape Monze there is a

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Chart 61.

peak, 478 feet (145m7) high. For radar range *see* Appendix III on page 346.

A light is exhibited, at an elevation of 162 feet (49m9), from a tapering concrete tower, painted black and white in horizontal bands and 168 feet (51m2) in height, situated on the coast, about one mile south-eastward of the western extremity of Cape Monze (*Lat. 24° 50′ N., Long. 66° 40′ E.*).

A shoal, with a least depth of 32 feet (9m8), is situated about 3¾ miles west-south-westward of Buleji point, and shoal patches, each with a depth of 27 feet (8m2), lie about 1½ miles west-south-westward and 3½ miles westward, respectively, of the point.

The depths in the vicinity of Cape Monze are irregular and a spit, with depths of less than 10 fathoms (18m3), extends about 3½ miles south-westward from the lighthouse. Nancowry shoal, consisting of a series of sand, gravel and coral ridges with depths of less than 6 fathoms (11m0), lies on the inshore part of this spit. Two 6-fathom (11m0) patches also lie on the spit about 1½ and 2¼ miles, respectively, south-westward of Cape Monze lighthouse.

Chart 41.

In 1952, a depth of 23 fathoms (42m1) was reported about 21½ miles southward of Cape Monze lighthouse.

Chart 61.

Vessels should round Cape Monze at a distance of not less than 2¾ miles.

Beauchamp reef, with a least depth of 6½ fathoms (11m9), is a narrow ridge of sand, gravel and shell, about 1¼ miles long in a north-westerly and south-easterly direction, which lies about 3½ miles westward of Cape Monze; it has general depths of from 6½ to 7 fathoms (11m9 to 12m8).

The coast and dangers northward of Cape Monze are described in the Persian Gulf Pilot.

Charts 39, 61, 41.

Submarine and Naval exercise areas.—Submarine exercise areas exist in the approaches to Karāchi harbour outside the 20-fathom (36m6) line within an area enclosed by lines joining positions 16½ miles westward, 38 miles south-westward, 49 miles southward and 18 miles south-south-eastward of Cape Monze.

Naval exercises also take place in parts of the above area and also within the 20-fathom (36m6) line between Manora point and Cape Monze.

Charts 40, 61.

Pilotage.—Pilotage is compulsory for merchant vessels of over 200 net registered tons.

Pilots board incoming vessels by day or at night, about 2 miles south-westward of Manora Point lighthouse (*Lat. 24° 48′ N., Long. 66° 59′ E.*). If, owing to bad weather, a pilot cannot be sent out to a vessel a signal to that effect is sent from the signal station near Manora Point lighthouse.

While awaiting the pilot a vessel should heave-to head to wind and sea, and on the approach of the pilot cutter should bring the wind and sea on the port quarter, and remain hove-to until the pilot has boarded. A pilot ladder with two manropes should be lowered on the lee side.

Charts 38, 826, 748b.

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Charts 40, 61.

The best approach is with Manora lighthouse bearing 045°, but it is dangerous to proceed within 2 miles of the harbour entrance, and under no circumstance should a vessel attempt to enter harbour without a pilot.

Outward bound, the pilot leaves at the harbour entrance, and from this position a course of 225° should be maintained for at least 2 miles.

On no account should the lighthouse be brought to bear less than 030°, owing to the heavy rollers and swell on the edge of the flats.

Anchorages.—From September until the end of March vessels can anchor in a depth of about 5 fathoms (9^{m}1), with Manora Breakwater lighthouse bearing between 024° and 047°, distant three-quarters of a mile; during the months of April and May they should anchor about half a mile farther offshore, between the same bearings, in a depth of about 6½ fathoms (11^{m}9).

Vessels should not anchor off Karāchi during the south-west monsoon, as several vessels have lost anchors and cables whilst attempting to do so in the outer anchorage during this season. *See* also remarks under Pilotage above.

Tidal streams.—In the outer anchorage the flood stream sets eastward, and the ebb, which is hardly perceptible, westward. *See* also page 340.

Currents.—*See* page 332.

Chart 41.

Directions.—There are no good landmarks when passing the delta of Indus river for a vessel making Karāchi from the southward, and land is not generally seen before sighting Manora point; sounding is therefore the only sure guide, but from October to May, as already stated on page 332, Sindhi light-buoy is moored, in depths of from 10 to 20 fathoms (18^{m}3 to 36^{m}6), off Turshian mouth. The Swatch, about 90 miles southward of Karāchi, can give a vessel a clear indication of her position by the use of echo sounding.

Several vessels have grounded on the banks off the Indus delta through neglecting sounding, and not making due allowance for the south-easterly set, *see* page 332.

A vessel coming from the westward can make a good landfall off Cape Monze (*Lat. 24° 50′ N., Long. 66° 40′ E.*).

The best time to enter Karāchi is on the first or last of the flood tidal stream; a vessel should swing to an anchor, and berth with her head southward.

On all occasions of berthing during the south-west monsoon it is advisable to drop an anchor in mid-stream to assist in hauling off.

Caution.—The electric lights used on East wharf (page 339) can be seen from some distance to seaward, and care is necessary when approaching the port not to mistake them for lights exhibited for navigational purposes.

Chart 40.

KARĀCHI HARBOUR.—Karāchi harbour is about 3½ miles in length and, in depths of over 20 feet (6^{m}1), is from 1¼ to 2½ cables wide. In 1959, there was a dredged depth of 29 feet (8^{m}8) in the entrance and 27 feet (8^{m}2) in the fairway through the harbour. Dredging is constantly in progress to maintain these depths but silting is liable during the south-west monsoon.

Charts 38, 39, 826, 748b.

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Chart 40.

In 1959, the authorised maximum draught for vessels entering or leaving the port during the south-west monsoon was 32 feet (9^{m}8); this may however be increased or decreased at the discretion of the port officer according to the state of the weather and sea.

A vessel of 20 feet (6^{m}1) draught can enter or leave the harbour at any time of the day or night.

There is no anchorage for large vessels above the quarantine anchorage at the entrance to the harbour, but the moorings and wharves are sufficient to accommodate about 34 ocean-going vessels.

The harbour is divided into lower and upper harbours; the lower harbour, where the majority of the moorings are situated, extends from the entrance to the southern end of East wharf, about 1½ miles north-north-westward; all alongside berths, except the oiling pier, lie in the upper harbour which extends northward from the southern end of East wharf.

The port authority is the Karāchi Port Trust; there is a Deputy Conservator at Karāchi, a Dockmaster at Keamāri and a Harbour Master at Manora.

Lower harbour. — Signal station. — Dangers. — Beacons. — Lights.—Buoyage.—Manora Point peninsula and breakwater (*Lat. 24° 47′ N., Long. 66° 59′ E.*) are described on page 333. At the north-western end of the north-eastern side of the peninsula there are a number of piers known collectively as Manora jetties; they include Qāsim, Pilot, Crane, Passenger and Bahadur piers.

On the flood tidal stream during the south-west monsoon a considerable swell rolls into the outer harbour making boat work at the Manora jetties somewhat hazardous.

The signal station for communicating with vessels inside the harbour stands near the root of Bahadur pier.

The coastal bank, with depths of less than 3 fathoms (5^{m}5), extends about 1½ cables off the north-eastern side of Manora Point peninsula and breakwater.

Deep Water Point rock, which sometimes dries, lies on the coastal bank with its north-eastern edge about 2½ cables northward of Manora Point lighthouse and about one cable offshore. A red conical buoy is moored about half a cable eastward of the rock.

A number of mooring buoys lie on the coastal bank between Deep Water Point rock and the northern extremity of Manora Point peninsula.

From the northern extremity of Manora Point peninsula mud flats, which dry from 2 to 6 feet (0^{m}6 to 1^{m}8), extend in a north-north-westerly direction. Sālehābād, Bunker, Bhit and Bāba islands lie on or near the eastern edge of these mud flats about 9 cables, one mile, 1½ and 2 miles north-westward, respectively, of Manora Point lighthouse. There is a training wall between Bunker and Bhit islands.

The northern part of Bunker island is occupied by Karāchi Yacht club with its jetty and flagstaff.

Bhit and Bāba islands are low and sandy with many wooden huts on them; they are densely populated by fishermen and other seafaring people; each island has a jetty near its north-eastern end. Numerous fishing boats and local trading craft are usually anchored off these islands.

Charts 61, 41, 38, 39, 826, 748b.

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Chart 40.

A beacon, 75 feet (22m9) high, surmounted by a cage, stands on the eastern extremity of Bhit.

Extensive mud and mangrove swamps extend westward and south-westward from these islands through which there are numerous creeks, the most important being Yari creek, between Bhit and Bāba, leading to a Naval jetty.

The coastal bank, with depths of less than 3 fathoms (5m5), extends about 2½ cables off Bunker island, the training wall and Bāba island.

Bāba pool (page 340), with depths of from 18 to 25 feet (5m5 to 7m6), is situated abreast Bhit island. A conical buoy, painted red and white in chequers, is moored off the south-western extremity of the pool and there is a mooring buoy in the centre of it.

Several mooring buoys lie on the coastal bank abreast Bunker island (*Lat. 24° 49′ N., Long. 66° 58′ E.*).

The north-eastern side of the lower harbour is formed by Keamāri groyne, which extends about 1¼ miles south-south-eastward from a point about 1¼ miles northward of Manora Point lighthouse.

A post stands on the southern extremity of Keamāri groyne, and two posts and four concrete pillars exist within 2 cables south-eastward and 2¾ cables east-south-eastward of the post.

A beacon with a cage topmark, 55 feet (16m8) in height, a stone monument, 13 feet (4m0) in height, a beacon with a cage topmark, 36 feet (11m0) in height, and a beacon with a diamond topmark, 17 feet (5m2) in height stand on the groyne about one-quarter of a cable, 2¼ cables, 6¼ cables and one mile, respectively, from the post on the southern extremity.

The coastal bank, with depths of less than 3 fathoms (5m5), extends between three-quarters of a cable and 1¼ cables off Keamāri groyne. The 3-fathom (5m5) line extends in a south-south-easterly direction from its seaward end.

An oiling pier (page 341) extends from the shore between the root of Keamāri groyne and the southern end of East wharf. The extensive oil storage installations north-eastward of the root of Keamāri groyne are visible for a considerable distance.

Two lights are exhibited from the oiling piers when no vessel is berthed alongside.

The entrance channel and the fairway through the lower harbour is from 1¼ to 2½ cables wide. It is marked between the entrance and Deep Water Point rock by black can and pillar light-buoys, each exhibiting a *green* light, on the western side, and by a red pillar light-buoy and red conical light-buoys, each exhibiting a *red* light, on the eastern side as indicated on the chart; the lights on the four southern-most buoys are *flashing* and the remainder *fixed*. The positions of the outer channel light-buoys are liable to be changed.

In 1959, the fairway was dredged to a depth of 29 feet (8m8) between No. 1 and a line close eastward of No. 3 pairs of light-buoys and to 27 feet (8m2) for the remainder of the lower harbour.

The entrance channel is liable to silting during the south-west monsoon.

On either side of the fairway northward of Deep Water Point rock there are moorings which are described on page 341. A *green fixed* light is exhibited from No. 6 mooring on the western side of the fairway

Charts 61, 41, 38, 39, 826, 748b.

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Chart 40.

and *red fixed* lights are exhibited from some of those on the eastern side as indicated on the chart.

Upper harbour. — Signal station. — Dangers. — Buoyage. — Light.—Beacons.—The upper harbour extends northward from the southern end of East wharf; the eastern side is formed by East wharf and the western side by the coastal bank off Bhit (*Lat. 24° 49′ N., Long. 66° 58′ E.*) and Bāba islands and by West wharf. The berths alongside East and West wharves are described on page 340.

The fairway through the upper harbour is from 1¼ to 2½ cables wide; in 1959, it was dredged to a depth of 27 feet (8m2) except for the northern half mile of the harbour, which is filled by a bank, with depths of less than 3 fathoms (5m5).

Eastward of the southern part of East wharf lies the small town of Keamāri, built on a sand ridge. Napier mole, of which East wharf forms the western side, extends north-north-eastward from Keamāri, and is connected with the mainland northward by Chinna Creek and Napier Mole bridges, which carry the railway and road, respectively.

A clock tower and signal station stand on East wharf abreast No. 7 berth.

The bank at the northern end of the harbour is marked by *Napier* black can light-buoy, exhibiting a *green fixed* light, moored off the 3-fathom (5m5) line about 3¼ cables westward of the southern end of Chinna Creek bridge.

Napier Mole Boat (N.M.B.) wharf, at the northern end of East wharf, and Fishermen's harbour and Juna bunder, on the northern side of the harbour, are fronted by the bank. They are described on page 340.

A light is exhibited from the western entrance point of Fishermen's harbour.

On the western side of the fairway through the upper harbour abreast the southern end of East wharf there are some moorings, which are described on page 341.

No. 9 red pillar light-buoy, exhibiting a *green flashing* light, is moored on the western side of the fairway about 3 cables north-north-westward of the southern end of East wharf.

North Shoal black can buoy is moored on the coastal bank about 1½ cables westward of No. 9 light-buoy with a spherical buoy three-quarters of a cable south-south-eastward of it.

The Pakistan Naval dockyard (*Lat. 24° 50′ N., Long. 66° 58′ E.*) lies at the southern end of West wharf, upon which stand two beacons, each 80 feet (24m4) high, a conspicuous chimney and a conspicuous water tank about 6½, 6¾, 7½ cables and 1¼ miles, respectively, north-north-eastward of the southern extremity.

On the south-eastern side of West wharf shoal water, with depths of less than 3 fathoms (5m5), extends up to half a cable offshore between the Naval dockyard and No. 22 berth. A floating dock lies on dolphins and there is a repair jetty about 4 and 5 cables, respectively, from the southern extremity of the wharf.

A black can light-buoy, exhibiting a *green fixed* light, is moored off the southern end of the floating dock; another similar light-buoy, No. 12, is situated off the north-eastern extremity of the shoal water.

Off the south-eastern side of the Naval dockyard there is an area dredged to a depth of 22 feet (6m7) as indicated on the chart.

Charts 61, 41, 38, 39, 826, 748b.

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Chart 40.

On the north-western side of West wharf there is a shipbuilding and repair yard, with a dry dock and fitting-out berths. North-eastward of the yard is the new Fish harbour, which was under construction in 1959. A training wall has been built, at a distance of about 1½ cables from the wharf, between Fish harbour and a position about 6 cables north-north-eastward of the northern end of Bāba island.

A channel, about half a cable wide, with a turning basin off the shipyard, leads along the western side of West wharf to the shipbuilding and repair yard; in 1959, the channel had a dredged depth of 25 feet (7ᵃ6) as far as the shipyard, and to a depth of 10 feet (3ᵐ0) from thence to the new Fish harbour. The channel is marked between No. 9 light-buoy and the southern end of the training wall by black can buoys on the western side and red conical buoys on the eastern side; some of the can buoys are however charted about half a cable outside the dredged fairway.

Bāba channel, between Bāba island and the above dredged channel, leads north-westward into Chari Kund channel; the latter is of little importance being only used by local fishermen and small craft; a beacon, 16 feet (4ᵃ9) high, surmounted by a rectangle, stands on the southern side of the entrance and another beacon, 8 feet (2ᵃ4) high, surmounted by two diamonds, stands on the southern side of Chari Kund channel about 7 cables west-north-westward of the entrance beacon.

Anchorage.—Bāba pool, on the western side of the fairway about 1½ cables eastward of Bhit island, has depths of from 18 to 25 feet (5ˏ5 to 7ᵃ6), but is surrounded by shoaler water; it affords good anchorage to small craft.

Quarantine.—Quarantine anchorage.—A vessel in which there have been either more than two cases of dangerous infectious disease, or in which more than two deaths have occurred, during the twelve days prior to her arrival at Karāchi, must anchor in the quarantine anchorage at the entrance to the harbour as indicated on the chart.

Tidal streams.—The flood stream sets eastward at a rate of 2 knots round the head of Manora breakwater (*Lat. 24° 47′ N., Long. 66° 59′ E.*), then into the harbour and up the channel towards the southern end of West wharf where it splits; in the upper harbour it is strongest on the western side; its greatest rate in the entrance is about 2 knots.

The ebb stream sets fairly down the upper harbour until abreast the oiling pier, where, under the influence of the ebb stream from Bāba channel, it sets strongly towards this pier and the eastern side of the channel; its greatest rate is about 3 knots at springs.

Directions.—*See* page 336.

Berths.—East wharf is the collective name given to all the wharves on the western side of Napier mole; it is capable of accommodating 17 vessels with draughts of from 26 to 29 feet (7ˏ9 to 8ˎ8).

From southward East wharf consists of Merewether wharf (berths 1 to 4), Erskine wharf (berths 5 to 8), James wharf (berths 9 to 11) Giles wharf (berths 12 to 14) and Younghusband wharf (berths 15 to 17).

The berths on East wharf are fully equipped for working cargo and are connected with the railway system.

Napier Mole Boat wharf, at the northern end of Napier mole, is for

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Chart 40.

the use of native craft; it has a depth of 8 feet (2m4) alongside and there is a depth of 13 feet (4m0) in the approach channel.

Juna bunder, at the northern end of the harbour, has depths of from 8 to 13 feet (2m4 to 4m0) alongside.

West wharf has six berths at its northern end on the south-eastern side, all connected with the railway. The northern and southern berths, Nos. 18A and 22, are lighter berths; Nos. 18, 19 and 20 are each 575 feet (175m3) long with depths of 32 feet (9m8) alongside; No. 21 berth is 600 feet (182m9) long with a depth of 30 feet (9m1) alongside; frequent dredging is necessary to maintain these depths.

There is a ship repairing berth about 1½ cables south-south-westward of No. 22 berth; it is 300 feet (91m4) long with a depth of 16 feet (4m9) alongside.

At the southern end of West wharf is the Naval dockyard; on the south-eastern side there are berths alongside for several vessels, dry and floating docks and a slipway; on the north-western side at the southern end an alongside berth, 502 feet (153m0) in length, was under construction in 1960.

There are berths in the shipyard on the north-western side of West wharf and the largest dry dock in Karāchi harbour is sited there; for details *see* Appendix I on page 343.

Keamāri Boat basin at the southern end of East wharf has depths of from 8 to 10 feet (2m4 to 3m0) alongside.

Oiling pier.—At the northern end of Keamāri groyne (*Lat. 24° 48′ N., Long. 66° 59′ E.*) there is an oiling pier for discharging vessels carrying dangerous oil in bulk; it is about 1,050 feet (320m0) long and, in 1959 there was a depth of 31 feet (9m4) alongside, but during the south-west monsoon this is sometimes reduced by silting.

Moorings.—There are numerous mooring buoys on the western side of the fairway in the lower harbour which have swinging radii of from 250 to 400 feet (76m2 to 121m9). These berths are used mainly by Pakistan Naval vessels. There are numerous mooring buoys for small craft in the shallow water close to the western shore of the lower harbour.

On the eastern side of the fairway, southward of the oil pier, are situated Nos. 13 to 16 head and stern moorings and on the western side, southward of No. 9 light-buoy, lie Nos. 6 to 12. These moorings are capable of accommodating vessels of from 500 to 600 feet (152m4 to 182m9) in length in depths of from 24 to 27 feet (7m3 to 8m2). The most southerly mooring on the eastern side of the fairway is used by vessels embarking or discharging explosives.

The port authority provides the stern cable and mooring boats. Vessels are advised to let go an anchor in mid-stream to enable them to haul off when leaving; the holding ground is bad, and caution should be exercised when hauling off as the anchor may come home.

Charts 40, 61.

Karāchi.—Karāchi is a Federal Territory and the principal seaport of Pakistan. The city is situated at the head of the upper harbour; the native town, which is the part closest to the harbour, is closely built and crowded; the new city contains many fine buildings, among the most conspicuous of which, from seaward, is Qamar House tower, about 3 miles north-north-eastward of the south-eastern extremity of Keamāri groyne.

Charts 41, 38, 39, 826, 748b.

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Chart 40.

In 1951, the population of Karāchi was 1,126,417, but in 1959 it was estimated to have increased to about one and a half million.

Port facilities.—Large stocks of fuel and diesel oils are maintained; it can be obtained from Nos. 1 to 8 berths on East wharf, the oiling pier or a barge with a capacity of 400 tons. The pumping rates are 120 tons an hour from East wharf, 250 tons from the oiling pier and from 80 to 100 tons from the barge.

A large stock of coal is maintained; it is supplied by lighter at a rate of 400 tons a day.

Provisions are available.

Water is laid onto the wharves and there are water boats for supplying vessels at moorings. Application for water should be made either to the Harbour Master at Manora or the Dockmaster at Keamāri (*Lat. 24° 49′ N., Long. 66° 59′ E.*).

There are three graving docks and one floating dock at Karāchi; details of the largest, on the north-western side of West wharf, are given in Appendix I on page 343.

Facilities for major repairs and dry docking are available; vessels are taken into and out of the dry docks by pilots of the Karāchi Port Trust.

Tugs and lighters are available. Three tugs and two other vessels are fitted with fire and salvage pumps. There is a 30-ton and a 60-ton floating crane as well as numerous cranes on the wharves.

All modern facilities are available in the civil and military hospitals.

Deratisation.—*See* page 29.

Life-saving.—Three powered lifeboats are maintained.

Storm signals.—Storm signals are displayed from the signal station near Manora Point lighthouse and from the northern entrance point of Keamāri Boat basin; the general system is used. *See* page 20.

Communications.—There is regular communication by sea with Europe, North America, Australia, the Far East, East Africa, the Persian gulf, East Pakistan and India.

Karāchi is one of the main transit air ports of the world; all traffic from Europe, the Middle East and Africa bound for India, the Far East and Australia passes through the airport. There are also direct services to North America through Africa and the United Kingdom.

Karāchi is the maritime terminus of the railway system, sidings from which run alongside all the principal wharves.

Radio and Radio D.F. stations.—There are radio and radio direction-finding stations at Karāchi. *See* page 24.

Trade.—Shipping.—The whole of the trade of West Pakistan passes through the port of Karāchi (*Lat. 24° 51′ N., Long. 67° 00′ E.*).

The principal imports are cotton and woollen piece-goods, manufactured goods, motor vehicles, constructional and industrial machinery, oils, coal, cement, metals, sugar and wheat; the principal exports are cotton, wool, hides, oil-seeds, salt and dried fish.

There are extensive fisheries.

In 1958, a total of 1,125 vessels with an aggregate tonnage of 4,708,258 entered the port.

Climatic table.—*See* page 55.

Charts 61, 41, 38, 39, 826, 748b.

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APPENDIX I

PARTICULARS OF DRY DOCKS, PATENT SLIPS, &c.

NAME OF PORT AND TYPE OF DOCK, &c.	Length from Bilge of Caisson or Mitre Post of Gates at		Maximum Length of Keel Blocks	Breadth of Entrance at		‡ Distance {below (+) above (−)} Chart Datum level of			Tidal data	FLOATING DOCKS, PATENT SLIPS, &c.			REMARKS
	Coping Head	Floor Head		Coping	MHWS Level	Sill	Blocks at			Maximum Depth over Blocks		Lifting Power	
							Entrance	Head	MHWS	Forward	Aft		
	(1)*	(2)*	(3)	(4)†	(5)†	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Tons	
COLOMBO:													
Dry Dock . .	705·6	702·6	650	85	83·8	+ 30·0	+ 29·75	+ 28·75	2·4	—	—	—	Length given in column 2 can be increased by 14·2 feet, by placing caisson in outer stop.
MANDAPAM:													
Dry Dock . .	264	—	—	50	50	+ 6·7	+ 6·7	+ 6·7	2·3	—	—	—	Limiting dimensions of ship that can be docked 260′ × 49′ × 8′ 6″ draught.
COCHIN:													
Dry Dock . .	243	240	222·3	44	44	+ 11·6	+ 11·6	+ 11·6	3·0	—	—	—	
BOMBAY:													
Dry Dock . .	997·6	997·6	997·6	100	100	+ 22	+ 20·6	+ 19·6	14·5	—	—	—	
KARACHI:													
Dry Dock . .	630·1	626·6	560	90	90	+ 17·5	+ 17·5	+ 17·5	8·2	—	—	—	
KANDLA:													
Floating Dock	265	—	—	65	65	—	—	—	21·9	22	22	800	Vessels of up to 240 feet in length, 46′ 4″ beam and 13 feet draught can be docked.

* In the case of Floating Docks, Patent Slips, &c., column (1) = Extreme length, column (2) = Length on blocks or cradle.
† In the case of Floating Docks, column (4) = Breadth at top, column (5) = Breadth at bottom of dock.
‡ In order to find the depths on sill, &c., the quantities in columns (6), (7) and (8) should be applied according to sign to the predicted or calculated height of tide as obtained from the Admiralty Tide Tables.

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APPENDIX II

LIST OF PRINCIPAL PORTS, SHOWING PARTICULARS OF DEPTHS, &c.

PORT	Depth below chart datum level		Tidal data		REMARKS
	In channel of approach	In anchorage	M.H.W.S. Feet	M.H.W.N. Feet	
Colombo: Western entrance .. Northern entrance ..	38 feet ..... 32 feet	36 feet.....	2·4 —	1·6 —	Vessels up to 35 feet draught can be berthed alongside and at moorings.
Tuticorin.....	—	27 to 33 feet...	3·0	2·1	
			M.H.H.W.	M.L.H.W.	
Cochin	30 feet	6 fms. in outer anchorage.	3·0	2·5	Vessels up to 700 feet in length and 28 feet draught can be berthed at moorings and 550 feet in length and 30 feet draught alongside.
Calicut.....	—	2 to 4¾ fms. ...	4·7	4·4	The port is practically closed from the beginning of June to the end of August.
Tellicherry	—	6 to 7 fms.	4·8	4·6	
Mangalore	—	5 fathoms	4·8	4·2	
Kārwār	—	6 to 7 fms.	5·7	5·2	A vessel may obtain anchorage in 4 fms. off the northern side of Kārwār head, if moored head and stern to face the west-north-westerly swell.
Pôrto de Mormugão	4½ to 5 fms. ..	9 fms. in outer anchorage. 3 fms. in inner anchorage.	5·6	5·2	Vessels up to 28 feet draught can be berthed alongside except during the south-west monsoon when the maximum permitted draught is 26 feet.
			M.H.W.S.	M.H.W.N.	
Bombay.....	30 feet	5 to 6 fms.....	14·5	10·8	Alongside berths available for vessels up to 34½ feet.
Bhavnagar New port	—	6 fms. in Gogha roads.	33·4	27·2	Vessels up to 28 feet draught, depending on the height of the tide, can be berthed alongside.
Okha	16–22 feet ...	7 fms. in outer anchorage.	11·6	9·2	

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Appendix II continued.

PORT	Depth below chart datum level		Tidal data		REMARKS
	In channel of approach	In anchorage	Feet	Feet	
Kandla	11 feet	6 fms. in outer anchorage. 4½ fms. in inner anchorage.	21·9	17·9	Vessels up to 25 feet draught can enter at H.W. Alongside berths available for vessels up to about 30 feet draught and moorings for those up to 29 feet.
Karāchi	29 feet	6½ fms. in outer roadstead.	M.H.H.W. 8·2	M.L.H.W. 7·9	Vessels up to 32 feet draught can enter during south-west monsoon. Berths alongside and at moorings available for vessels up to 32 and 27 feet, respectively.

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APPENDIX III

REPORTED RADAR RANGES

The following table, which has been prepared and supplied by The British Shipowners' Radio Advisory Service, gives the ranges at which echoes have been observed under normal conditions:—

Radar Target	Page in Pilot	Echo range in miles			Remarks
		Poor	Good	*Identifiable	
Addu atoll	57	15	10	—	—
Arnāla island	255	—	27	14	—
Bālāchiri rocks	314	—	19	—	—
Beypore peaks	158	28	—	—	—
Bombay harbour	230	—	22	—	—
Burnt islands	205	—	18	—	—
Chank Island light-structure	305	—	8	—	—
Colombo breakwaters	113	—	18	15	—
Colombo Fort light-structure	112	—	20	18	—
Comorin, Cape	138	—	23	12	—
Delly, Mount	168	—	18	—	—
Devgarh hill	208	—	14	—	—
Dwárka	293	27	23	—	—
Kadalur point	162	—	22	13	—
Kalpeni island	103	—	20	—	—
Kandufuri islet	97	—	15	—	—
Karāchi	334	10	—	—	Low shore
Malabar hill	235	—	40	—	—
Malabar point	235	—	22	—	—
Maldive islands	57	—	16	—	—
Manora point	333	35	—	—	—
Meda creek	293	—	16	—	—
Minicoy island	100	21	18	15	—
Monze, Cape	334	30	16	—	—
Muttum point	140	21	17	—	—
Netrani or Pigeon island	179	—	16	—	—
Porbandar	291	—	21	—	—
Prongs Reef lighthouse	235	—	17	—	—
Quilon	144	18	13	—	—
Samiāni island	298	—	12	—	—
Suheli Par atoll	103	—	16	—	—
Tolkeshwar point	219	—	23	—	—
Trivandrum	143	—	12	—	—
Turakuna island	97	—	15	—	—
Uleguma island	98	—	15	—	—
Vengurla rocks	205	—	18	—	—
Veravel lighthouse	288	—	—	9	—
Wagapur point	211	—	—	7	—
Wagaru island	97	—	13	—	—

* Identifiable with charted features from the shape and character of the echo.

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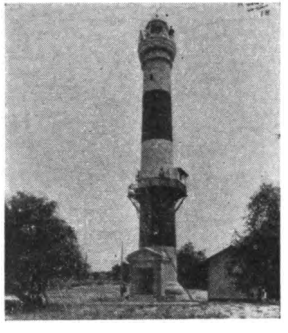
[1] (*page 101*)

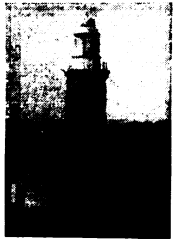
Minicoy island and lighthouse from south-westward.
(*Original prior to* 1917.)

[2] (*page 134*)



Pandyan Tivu
lighthouse.
(*Original dated* 1918.)

[3] (*page 141*)



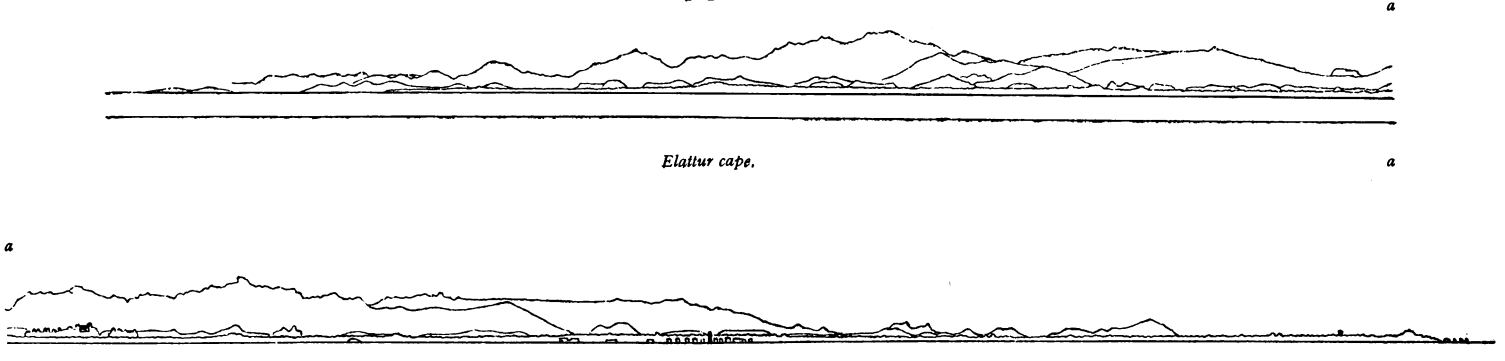
Muttum Point
lighthouse.
(*Original dated* 1918.)

Digitized by Google

[4] (*pages 156, 168*)

Mount Delly from southward.
(*Original dated* 1907.)

[5] (*page 159*)



View, in two parts, of the coast in the vicinity of Calicut.
(*Original dated* 1887.)

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[6] (*page 160*)

Calicut
lighthouse.
(*Original dated* 1918.)

[7] (*page 162*)

Kadalur
lighthouse.
(*Original dated* 1918.)

[8] (*page 165*)

Tellicherry
lighthouse.
(*Original dated* 1918.)

[9] (*page 172*)

Mangalore
lighthouse.
(*Original dated* 1918.)

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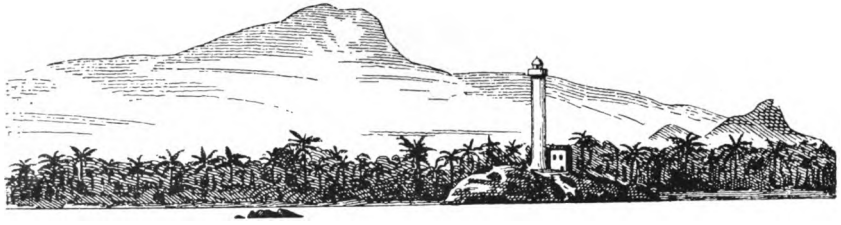
[10] (*page 173*)



Kāp lighthouse.
(*Original dated* 1907.)

[11] (*page 174*)

Malpe lighthouse.

North island. *Dārya Bāhādurgārh island.* *South island.*

Dārya Bāhādurgārh islands from westward.
(*Original dated* 1907.)

[12] (*page 175*)

Malpe lighthouse.
(*Original dated* 1918.)

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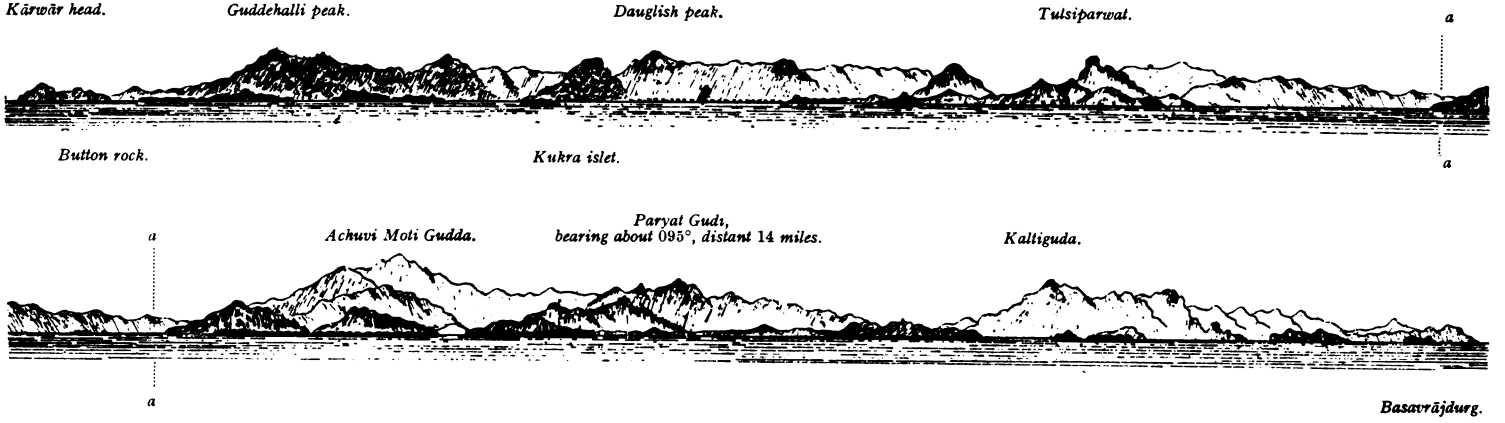
[13] (*pages 181–186*)



View, in two parts, of the coast from Kārwār head to Basavrājdurg island.

(*Original dated* 1911.)

[14] (*pages 186, 188*)

Oyster rocks.

(*Original dated* 1911).

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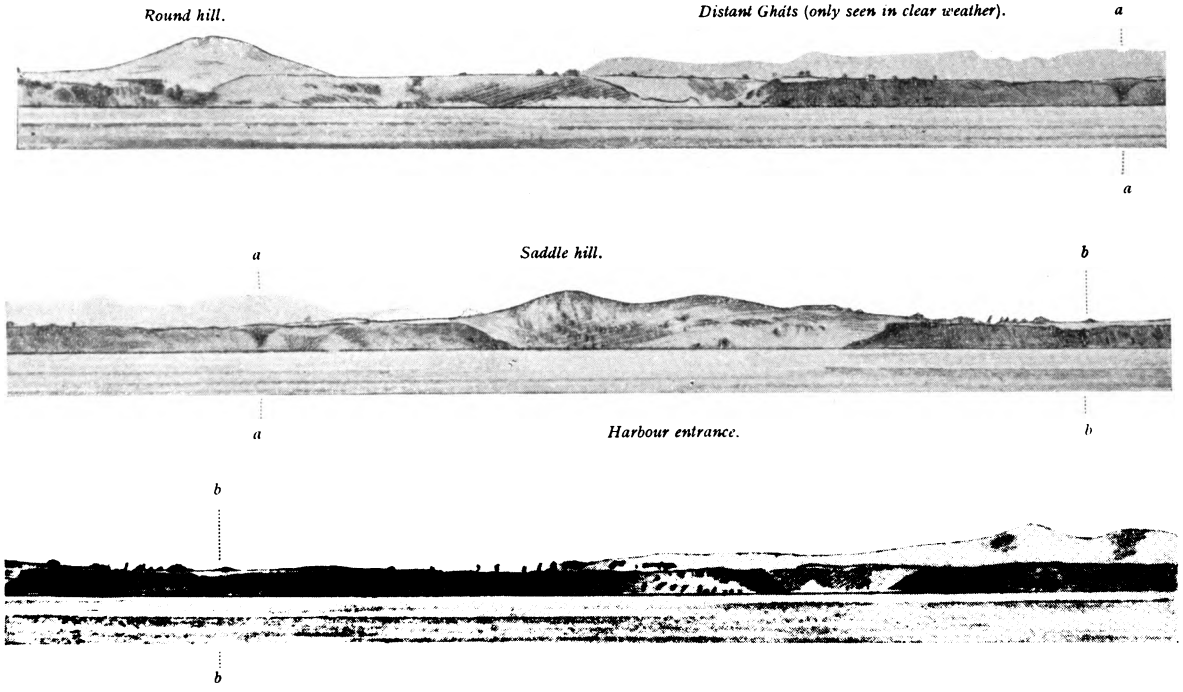
[15] (*page 210*)



View, in three parts, of the entrance to Deogarh harbour.

(*Original dated* 1892.)

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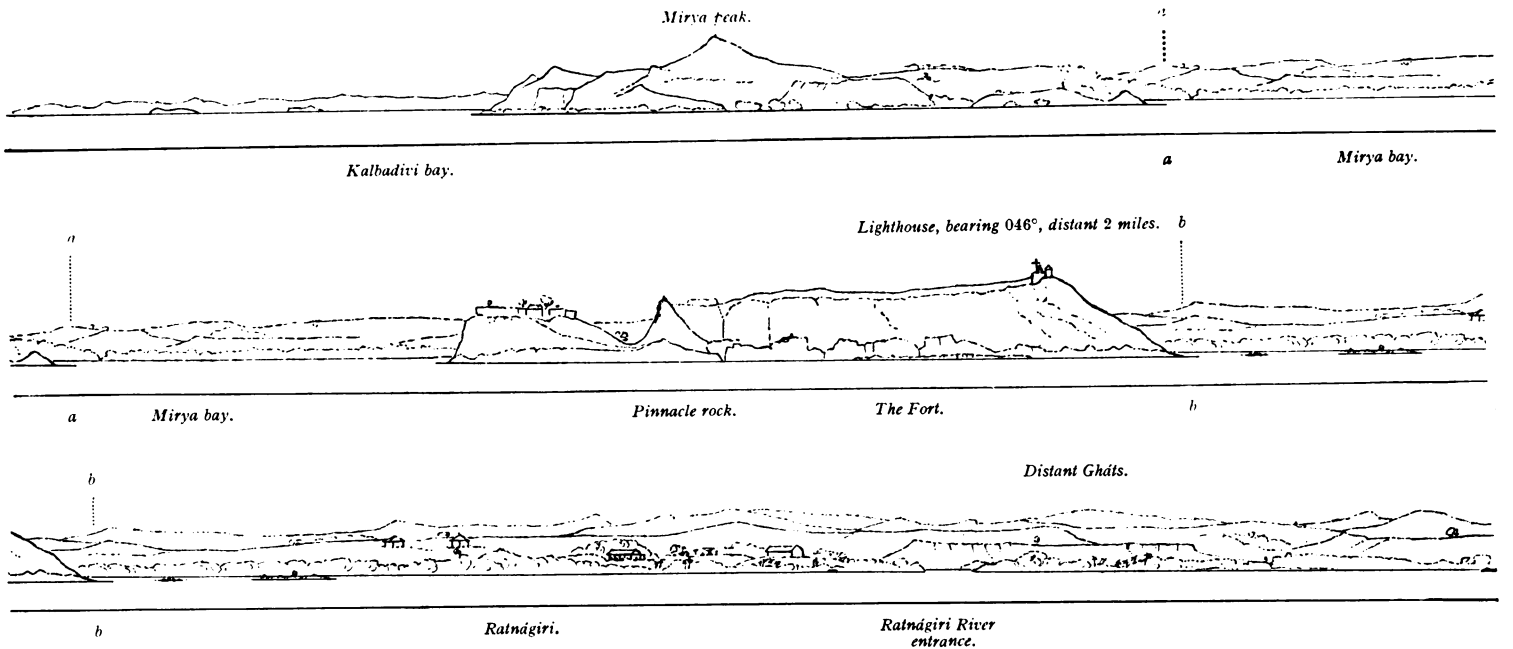
[16] (*pages 213, 215, 216*)



View, in three parts, of Kalbadivi, Mirya and Ratnágiri bays.

(*Original prior to* 1917.)

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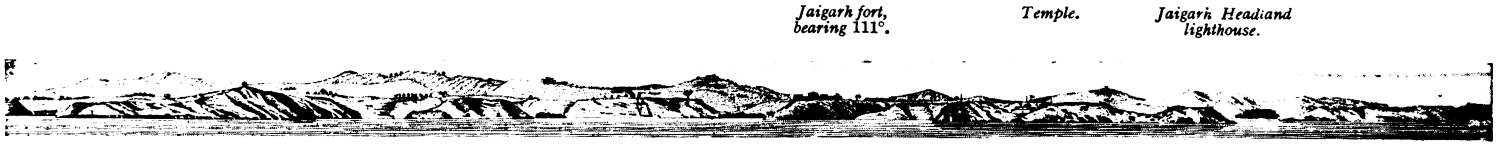
[17] (*pages 216, 217*)



Jaigarh bay and entrance to Shāstri river.
(*Original prior to* 1881.)

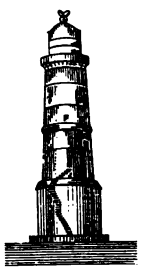
[18] (*page 233*)

Khānderi lighthouse.
(*Original dated* 1918.)

[19] (*page 235*)

Prongs Reef lighthouse.
(*Original dated* 1918.)

[20] (*page 237*)



Sunk Rock lighthouse.
(*Original dated* 1885.)

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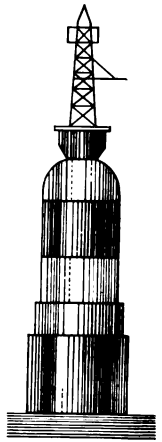
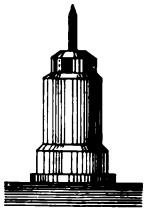
[21] (*page 239*)



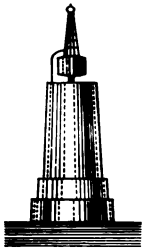
Tucker Beacon
(*Original dated* 1885.)

[22] (*page 240*)



Butcher Beacon
(*Original dated* 1885.)

[23] (*page 240*)

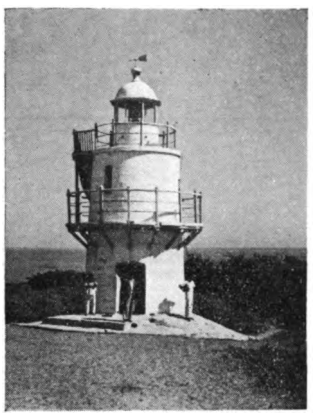


Uran Beacon
(***Original*** *prior to* 1885.)

[24] (*page 264*)

Luhara light-structure.
(*Original dated* 1910)

[25] (*page 266*)



Gopnáth lighthouse.
(*Original dated* 1950).

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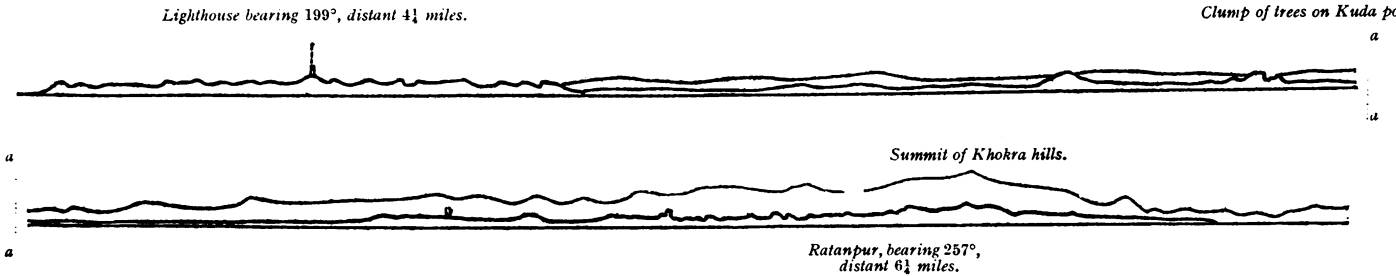
[26] (*page 267*)



View, in two parts, of Piram island and the coast of the mainland westward.
(*Original prior to* 1946.)

[27] (*page 268*)

Ruvapari lighthouse.
(*Original dated* 1926.)

[28] (*page 274*)

Gorakhnāth mountain, bearing about 068°, distant about 45 miles.
(*Original prior to* 1880.)

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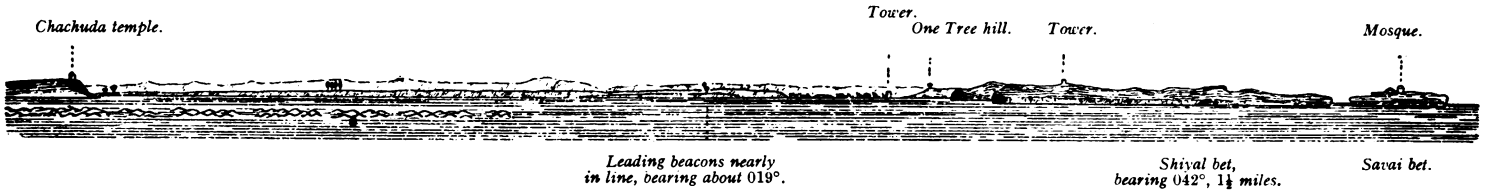
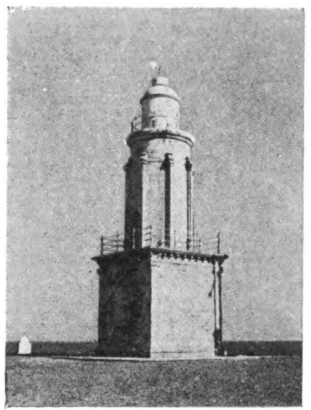
[29] (*page 279*)



Entrance to Port Albert Victor from southward.

(*Original prior to* 1928.)

[30] (*page 280*)



Jáfarabad lighthouse.

(*Original dated* 1950.)

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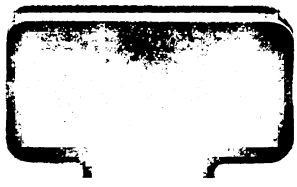

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